SCIENCE

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ANNUAL REPORT OF THE SECRETARY OF AGRICULTURE FOR 1900.

SECRETARY WILSON begins his report with a complimentary reference to the work of his predecessors which has brought the Department of Agriculture to its present state of efficiency. He declares his own aims to bring the Department scientists to the help of the producers, to ascertain what we import that they can produce, with a view to encouraging its growth; to search the world for grains, fruits, grasses and legumes, that they may be domesticated here and be an improvement on what we have; to secure new and improved varieties of plants by cross-fertilization; to cooperate with the experiment stations in all the States and Territories in research of practical value to the people of all sections; and to seek out new markets for our surplus products.

Mr. Wilson emphasizes the manner in which this Department differs from others. He says its appropriations should be regarded as an investment, for the reason that it makes direct returns therefor by adding to the wealth of the country, thus adding yearly largely to the profits of the farmers and others as the result of its investigations. He instances as money-saving or money-making agencies the Weather Bureau; the meat inspection; the pathological investigations of plants; the services of the entomologist; the services of the

Department on behalf of sugar and tea industries, of the orange industry, which owes its beginning and its preservation to this Department, of the tobacco industry, and others.

Then taking up the work of the Department in more detail, he reviews the operations of its several branches.

WEATHER BUREAU.

Important extensions of the Weather Bureau work have been made during the past year. Its efforts were specially directed to investigate methods of electrical communication without wires, with a view to establishing wireless electrical communication between vessels at sea and exposed points on our lake and sea coast. New appliances have been devised and receivers constructed more delicate than any heretofore made. Already messages have been successfully transmitted and received over 60 miles of land presenting a rough and irregular surface, and it is believed that the efficiency thus indicated would operate successfully over several hundred miles of water. This matter, says the Secretary, is of such importance to commerce that he has authorized further extensive experiments, and he expresses the hope that in the near future the craft employed in our coastwise commerce and on the Great Lakes will be placed in instantaneous communication with the stations of the Weather Bureau located at the principal ports.

Special storm forecasts for the North Atlantic will be undertaken shortly through the use of reports received from the West Indies, the Bahamas, Bermuda, the Azores, and Portugal, the new cable system connecting Lisbon with New York via the Azores making this possible. Much stress is laid upon the continued improvement of the forecast service and the value of its warnings. He points out that, notwithstanding the great number of craft plying the Gulf of Mexico at the time of the Galveston storm, the warnings were so timely that there was no disaster upon the open waters.

BUREAU OF ANIMAL INDUSTRY.

The number of abattoirs and packing-houses receiving the benefit of inspection was 148 in 45 localities, as against 138 in 41 localities the preceding year. The total ante-mortem inspections of cattle aggregated 53,087,994; animals rejected, subject to post-mortem, at abattoirs, 5,928; and in stock yards, 153,561. The total post-mortem inspections were 34,737,613, and the total carcasses condemned, 61,906. In the microscopic inspection of pork 999,554 carcasses were examined. Of these but 19,448, or 1.95 per cent., were found to contain living trichinæ. The total cost of inspection was but a few dollars over $700,000. Of vessels inspected by officers of the Bureau, 862 received clearances. Of the cattle shipped across the Atlantic, the loss amounted to but .24 per cent.; of sheep, .71 per cent., and of horses, 2.55 per cent. It is interesting to note the great increase in the number of horses exported. Of these, over 29,000 were landed from American ports at London, Liverpool and Glasgow.

During the quarantine season of 1899 over a million cattle were moved under the supervision of the Bureau from the district infected with the Southern cattle tick. In Texas alone, over 357,000 cattle were inspected for shipment to other sections. The sheep industry has suffered greatly from sheep scab, and much time and attention have been given to securing its control and eradication. Results so far are encouraging, and the Secretary believes that a few more years of earnest work will effectually eradicate the disease. Over 1,800,000 sheep were inspected, and nearly 627,000 dipped under the supervision of the inspectors.

The work of preparing serum for treating

hog cholera and swine plague, and experiments in treatment therewith, are continued, with results which, while they do not justify definite conclusions as yet, are sufficiently encouraging to justify continued experiments, including some on entirely new lines. Over one million doses of blackleg vaccine have been distributed during the year. Summarized reports of 2,000 cattle owners testify to its efficiency. Whereas a loss of 10 to 25 per cent. of young stock is reported in the districts where blackleg prevails, the loss where vaccination has been tried has been less than one-half of one per cent. From two to two and a half million doses will be required to supply the demand during the current fiscal year. The Bureau has already distributed 10,722 doses of mallein for testing horses for glanders, and 33,400 doses of tuberculin. Considerable space is given to the consideration of tuberculosis, 'the most prevalent and most destructive disease affecting mankind and the domesticated animals.' A great increase in the disease is noted in the principal countries of Europe, especially, unfortunately, in those whence American breeders desire to obtain animals for improving their stock. Arrangements have been made to station an inspector in Great Britain to test and certify to the animals before shipment. The suggestion is made that uniform regulations under Federal authority will save shippers much annoyance and loss, owing to the numerous restrictions imposed by individual States, and at the same time furnish adequate protection.

With regard to rabies the Secretary declares that this disease is unfortunately on the increase in the United States, and that local authorities have in most cases not efficiently controlled its outbreaks. He refers especially to its existence and increase in the District of Columbia, and points out the special danger to children from rabid dogs. Owing to the very serious expense to families in moderate circumstances in subjecting their children to the Pasteur treatment, he recommends either that the Secretary of Agriculture be authorized to pay for such treatment for parties bitten in the District, or that one of the medical services of the government be directed to furnish such treatment free of charge.

The report states that ticks received from Porto Rico have been found identical with the well-known Southern cattle tick. The main problem still presented by the Texas fever question is the finding of a dip that will effectually destroy the tick without injuring the cattle. Efforts in this direction are to be continued.

Experimental shipments of dairy products are still continued, and shipments of butter have been extended to Cuba and Porto Rico. The Department is seeking to obtain information useful to butter exporters in canning butter and producing butter especially adapted to shipment to warm countries. Some countries sending butter to these markets show a disposition to adapt their products to the needs of those countries, which is an example our producers must follow if they are to compete successfully with them. The Secretary earnestly recommends an inspection of dairy products designed for export. He points out the example of other countries, whose large foreign trade in dairy products has been principally developed owing to the fact that their best products bear a Government stamp, guaranteeing the article to be as represented.

DIVISION OF CHEMISTRY.

Elaborate work in the investigation of food adulteration has been continued. Over 500 samples of preserved meats of all kinds, purchased in open market, have been examined. The meat of the horse has been

examined for the discovery of a method whereby it may be detected when sold under another name. Very little of it seems to be sold in the United States, whether under its own name or any other name. Active cooperation has been had with other bodies, notably the Pure Food Congress, in an effort to secure legislation on the subject of food adulterations. National legislation on the subject is urged as essential to supplement and make efficient the work done in the several States. The sugar-beet work has been prosecuted with vigor and intelligence. Foreign food products introduced into this country have been the subject of careful study. The results are confidential and are used for the information of the authorities of this country controlling imported food products. Cooperation of the chief chemist has been invited in several other directions and always cheerfully extended. So, also, there has been cooperation with the other divisions of the Department where chemical work has been necessary.

DIVISION OF ENTOMOLOGY.

Most satisfactory reports are received from California as the result of the entomological work in the introduction of the insect which fertilizes the Smyrna fig. In one locality more than six tons of Smyrna figs have been produced. The result will be to make America a grand competitor in the fig trade of the world's markets. An important parasite has been introduced to prey upon the olive scale, so injurious to the olive growers of California. From Natal a fungous disease has been introduced by which injurious swarms of locusts have been destroyed. Efforts have been made to introduce European parasites of the gypsy moth.

DIVISION OF BOTANY.

The results of seed testing are declared to be satisfactory and to have greatly improved the quality of the seed distribution by Congress. Further improvement, however, is necessary in purity of stock or trueness to name. As the new seeds and plants introduced from foreign countries demonstrate their adaptability, they will become available for Congressional distribution. Experts of the Division had been studying plants poisonous to stock in Montana, and a report on the subject will be soon forthcoming. Valuable experiments will be conducted upon the ground set aside for the use of the Department on the Potomac Flats at Washington. Especial attention is called to experiments with American clover seed, which have shown that the American seeds are decidedly more valuable than the European.

SECTION OF SEED AND PLANT INTRODUCTION.

Seed and plant introduction receives extensive notice, special stress being laid upon the importations of cereals, including the macaroni wheats of Southern Europe, of grasses and forage plants and of vegetables which have already demonstrated their value. The Kiushu rice introduced from Japan has already added 1,000,000 bushels annually to the Louisiana rice crop. The successful introduction of date trees in Arizona is another valuable achievement. In concluding this subject Secretary Wilson cites the introduction of wheats from Russia, Hungary and Austria, greatly exceeding in yield our present varieties, and points out that if, as the result of these introductions, the wheat yield of the United States should be increased by but one bushel per acre, this would mean at the farm price for wheat in 1899, an addition of $26,000,000 to the income of our farmers.

DIVISION OF VEGETABLE PHYSIOLOGY AND PATHOLOGY.

This work is now divided into five important branches, namely, plant pathology,

plant physiology, Pacific coast investigations, plant breeding and plant nutrition and fermentation. The Secretary believes that excellent results will be obtained from the systematization of the work of this Division. In plant breeding orange hybrids have been placed at various points in the South, and their value has been tested in cooperation with several experiment stations. In corn breeding the features aimed at are early maturity, drought and smut resistance, increased protein content, and a large yield. Diseases of the sugar beet have been investigated, also diseases of forest trees. The transfer of Mr. B. T. Galloway as chief to the Directorship of Plant Industry, and the succession to the chiefship of Mr. A. F. Woods are noted.

DIVISION OF POMOLOGY.

The most important work of the year in this line was the establishing and maintaining at the Paris Exposition of an exhibit of horticultural implements, seeds, plants and fruits. This exhibit attracted wide attention, and the Secretary believes its ultimate effect will be most beneficial to American producers. No other country, it seems, attempted to maintain a continuous fresh-fruit exhibit. A special effort has been made to give a thorough test to the cultivation of choice European grapes in the South Atlantic States.

DIVISION OF AGROSTOLOGY.

This work has also been divided into several sections and thoroughly systematized. As a result of experiments in Texas, the grazing of pastures has been so much improved that, where three years ago they were estimated as capable of supporting one steer to 16 acres, they will now maintain in good condition one steer to 8 acres, a gain of 100 per cent. Among the objects of cooperative effort are the following: Range improvement, formation and management of meadows and pastures, forage plants for alkali soils, soiling crops, winter pasturage, etc. Particular attention has been devoted to collecting seeds, roots, and plants of notable native grasses. The grass garden on the Department grounds, containing nearly 500 varieties, has been maintained, and seeds of some 200 varieties have been distributed.

DIVISION OF GARDENS AND GROUNDS.

The Secretary refers in most complimentary terms to the late Mr. Saunders, so many years in charge of this and other important branches of the Department work, and reports the transfer of the experimental gardens and grounds, since Mr. Saunders's death, to the control of Mr. B. T. Galloway. Considerable space is given to tea production in the United States and to the opportunity this industry affords of utilizing the labor of colored children in the South, while at the same time affording them a good education. The claim is made that it has been demonstrated that tea can be produced in the United States for family use in gardens and also on a commercial scale. It has been shown that a good grade of tea can be produced for 15 cents a pound, or about $60 per acre, counting an average yield 400 pounds. Such tea should sell for at least 30 cents. In future special attention will be given to the manufacture of green tea.

BIOLOGICAL SURVEY.

The destruction of prairie dogs has become a practical question of great interest to farmers, and is being investigated by the Department. Warning is given of the possible danger of the introduction and dissemination of the Belgian hare. It is reported by the State Board of Horticulture in California that several thousands of these animals are now at large throughout the State, and their rapid multiplication will make them a source of great injury. Lab-

oratory work and study of the food of birds of economic importance have received attention. Special note is made of the Lacey Act, by which the Secretary of Agriculture is charged with the supervision of the importation of birds contemplated by this Act of Congress. Congress has authorized the Secretary to adopt such measures as necessary to carry out the purposes of the Act; and it is urged that the present appropriation being inadequate for the purpose, an increase should be provided.

SOIL SURVEY.

This work has been greatly extended, but stills falls far short of meeting the demand for soil surveying from all sections of the country. For this reason a considerable increase has been asked for. Letters and resolutions endorsing the work and urging its extension as one of great practical value have been received from many individuals and organizations. Owing to its costliness, and the widespread demand for it, the Secretary recommends that Congress provide for the printing of the annual report of this Division, as is now done with the annual reports of the Weather Bureau and Bureau of Animal Industry.

The Secretary feels highly encouraged by the results of the work of this Division with tobacco. He notes especially the successful results of an attempt to grow the Sumatra leaf in Connecticut. Sumatra tobacco imported costs our consumers, with the duty, $15,000,000. Of this $6,000,000 goes to foreign producers. He believes that in a short time this will be saved for our own tobacco growers. The tobacco exhibit at the Paris Exposition was one of the largest as well as the most complete ever made. It contained over 2,000 samples. The Florida-grown Sumatra was awarded 20 points of merit against 18 points for Sumatra, and the bright yellow of North Carolina was awarded as many points as the Turkish tobacco with which it competes.

FORESTRY WORK.

There has been a great growth in this work, which is of such a kind as to fully justify additional resources. Moreover, there has been an enormous increase in the demand, both public and private, for services of this character throughout the country. The relations of the Division of Forestry with practical lumbermen and tree planters have been closer and more useful than ever before. The total membership of the force at the highest last summer was 125. The public interest in forest matters is not only keener and wider than at any time before, but it is growing with rapidity beyond precedent. Cooperation in forest work has been sought of this Department by the Secretary of the Interior in reference to the national forest reserves, and from the Forest, Fish, and Game Commission of New York, for working plans for the New York State Forest Preserves. The total requests for working plans at the close of the year exceeded 50,000,000 acres, of which two and a half millions were private land. Personal examinations were made of 48 tracts in 14 States, covering nearly 900,000 acres, plans were actually prepared for 200,000 acres, and 50,000 acres were put under management. Tree-planting plans were made for 59 applicants.

The department is receiving with increased frequency applications for planting and working plans for watersheds from which cities obtain their supplies. A typical instance is that of the Water Company of Johnstown, Pennsylvania, one of the chief objects being to prevent a recurrence of the disaster there.

Studies of commercial trees, with a view to ascertaining rate of growth and production and other facts germane to the best practical forestry, were considerably extended.

PUBLIC ROAD INQUIRIES.

There is much inquiry in all sections of the United States regarding better roads and better methods of building them. It has been deemed wise to divide the country into four sections, and to appoint in each an expert agent. This has been done, and one appointed in the Eastern States, one in the Southern, one in the prairie States, and another in the Rocky Mountain States. These gentlemen are to study the needs of these several sections, give instruction as to road building, and report regularly to the Department. They will, moreover, supply samples of road material for analysis and testing, a testing machine having been arranged for in the laboratory of the Division of Chemistry, to be operated by an expert under the joint supervision of the director of road inquiry and the chief chemist.

Much work has been done in the past year in cooperating with the colleges and stations and the people of the several States in building experimental roads, and generous acknowledgment is made of the services contributed to the cause of good roads by the various transportation companies throughout the country.

OFFICE OF EXPERIMENT STATIONS.

The Secretary reviews at considerable length the work of the experiment stations first established in this country twenty-five years ago. Until 1887, the date of the Hatch Act, stations had been established in only fourteen States. Under this Act the enterprise was extended to cover the entire country, and the great success which, on the whole, has attended the establishment of the stations in all the States and Territories is very remarkable. Including the $720,000 received from the National Government, the total revenues of the stations during the year amounted to $1,200,000. The stations now employ rearly 700 persons, and in 1899 their publications aggregated 445 reports and bulletins.

The Secretary advocates a more complete separation of the business of the station from the general business of the college, and, where possible, the appointment of a director of the station as a separate officer. He believes it to be a mistake, on the whole, to divert the time and energy of competent investigators to the routine work of inspection service. While the Department of Agriculture is by law organized as an administrative agency as well as a great scientific institution, the stations, on the other hand, are organized solely to carry on investigations for the benefit of agriculture.

Cooperative enterprises between the Department and the stations have increased in number, and also in scope and variety. Both the officers of the Department and of the stations are greatly interested in cooperation, which, it is believed, may be systematized and greatly extended, thus adding much to the efficiency of both the Department and the stations.

Progress is noted in the experiments conducted in Alaska, and the establishment of substations is recorded. It is admitted that Alaska can never become an agricultural country, but the problem the Department has undertaken to work out is to determine whether a sufficient agriculture may be developed in Alaska to form an important subsidiary industry to aid in the development of mining, fisheries and lumbering. It has already been shown that green vegetables raised in Alaska have been an important factor in maintaining the health of mining communities. There are large areas on the western peninsula and the islands naturally adapted to live stock. For a considerable period the Department's operations in this Territory will partake of the nature of an agricultural survey to determine where agricultural operations may be best carried on. The

Secretary makes a comparison of Alaska with Finland, which supports a population of 2,500,000 souls, and which produced in 1895 nearly 40,000,000 bushels of cereals, besides exporting nearly $7,000,000 worth of dairy products.

As the result of investigations in Hawaii and Porto Rico, the Secretary believes that experiment stations should be established in these dependencies, and that they should receive for this work an annual appropriation equal to that given to the other Territories.

Investigations on the food and nutrition of man have been continued, largely in cooperation with the stations and colleges. This subject is one touching every household, numerous public institutions and the army and navy, and the results obtained can be made of great practical value. Household economics is rapidly taking its place among the required studies of our institutions of learning.

Much consideration is given in the report to the irrigation investigations, which in accordance with the terms of the appropriation act, cover especially two general lines of investigation, namely, the study of the laws and institutions relating to irrigation in different regions, and secondly, the determination of the actual use made of irrigation waters.

Eight typical streams in different parts of California have been thoroughly studied with reference to the conditions under which the water for irrigation is owned, distributed, and used. Similar investigations on a smaller scale have been made in Utah, Colorado, and elsewhere. Interest in the use of irrigation to supplement rainfall in the humid regions is growing, and valuable investigations have been made in New Jersey and have also been undertaken in Missouri and Wisconsin in cooperation with the experiment stations in those States.

The Secretary calls attention to the fact that on the supply of water for irrigation and its equitable distribution depends the permanent existence of civilized life in one-third of the area of the Union. Throughout this vast region questions relating to irrigation are vital to the ultimate solution of its problems, and must be found not only in State legislation, but in the action of the National Government. Most of the streams used for irrigation cross State lines, while some run partly in foreign countries. What is needed in this matter at the present time above everything else is the impartial ascertaining and recording of the facts relating to irrigation in this country. It is this task which the Department has set for itself.

SECTION OF FOREIGN MARKETS.

The study of markets abroad with special reference to extending the demands therein for the agricultural products of the United States has been prosecuted with zeal and intelligence. From the records of this section we derive most satisfactory information as to the development of our agricultural exports. While it is true that these bear a somewhat smaller proportion to the total exports than formerly, nevertheless the actual increase is very great. During the fiscal years 1897–1900 our total sales of domestic farm products to foreign countries aggregated the enormous sum of $3,186,000,000, an excess of $800,000,000 over the preceding four-year period. The agricultural exports of the United States for the past fiscal year amounted to $844,000,000. The rapid growth of our export trade to the Orient in recent years is most striking. Five years ago our total shipments of domestic merchandise to Asia and Oceania were valued at $43,000,000, of which only $9,700,000 were agricultural. There has been a steady increase in each succeeding year, until in 1900 our export trade with the Orient amounted to $107,000,000, of

which $30,000,000 worth was farm produce. Of this great increase in the growth of our agricultural exports to that quarter of the globe, amounting to something over $20,000,000, $11,500,000 consisted of cotton, and $3,400,000 of wheat flour.

During the past fiscal year Cuba, Porto Rico, the Hawaiian Islands and the Philippines furnished a market for $45,000,000 worth of our domestic products. Five years ago these islands took but $13,000,000 worth. During the fiscal year 1900 we sold to these islands $20,000,000 worth of farm produce, an increase of $13,700,000 over 1896.

DIVISION OF STATISTICS.

Efforts in this Division have been mainly directed to strengthening and improving the Department's several crop-reporting agencies. Two statistical field agents now devote their entire time to systematic visitation of the principal centers of agricultural industry. Much good is derived from their efforts. At the same time it is gratifying to state that the reports from the Department's regular correspondents have never before been so numerous, complete and prompt.

DIVISION OF PUBLICATIONS.

The Secretary notes with gratification that appreciation of the Department's work, as manifested in the demand for its publications, is every year more evident; so that with an annual output exceeding in the aggregate 7,000,000 copies, refusals to applicants are in many cases imperative. The number of new publications issued during the fiscal year was 320, against 297 for 1899; of reprints there were but 148 in 1900, against 306 in 1899; of Farmers' Bulletins 108 were issued, aggregating 2,360,000 copies. Even this enormous number fails to meet the requirements of Congress, which in this year's appropriations has provided for a still larger issue, and has reserved for the use of Senators, Representatives and Delegates four-fifths of the number printed, in lieu of two-thirds, as heretofore. The calls upon this Division from all parts of the country for publications, involved replies to 300,000 separate communications during the year, besides which more than 3,300,000 names and addresses had to be written in the distribution of documents.

THE LIBRARY.

Five thousand volumes have been added to the Library during the year, and cards have been issued to nearly 4,000 libraries, containing entries of all articles in the Yearbooks and Farmers' Bulletins issued to date.

ACCOUNTS AND DISBURSEMENTS.

Appropriations for the Department for the fiscal year ended June 30, 1900, amounted to $3,006,022, an excess over 1899 of $176,320. In addition, the usual sum of $720,000 was provided for division among the State agricultural stations. Expenditures and liabilities incurred during the year were $2,975,000. During the year $4,440 was paid for the rental of leased buildings in Washington.

PARIS EXPOSITION AWARDS.

The final official list of the Paris Exposition awards has not yet reached the Department, but preliminary reports supplied by its representatives in Paris record about 500 awards to United States exhibitors in agricultural, horticultural and food products. The United States was also generously considered in the forestry and tobacco classes.

AFFILIATION OF ALLIED LINES OF WORK.

The Secretary lays particular stress upon the necessity of adopting from this time forward a policy of aggregation rather than segregation in the development of the Department work, so as to bring together the

related lines of work without, however, interfering in any way with the integrity of the organization of the several Divisions. He reports the affiliation in this manner of four important Divisions closely allied by the nature of their work under the name of the Office of Plant Industry.

LABORATORY BUILDINGS.

An urgent recommendation is made for the erection of new, fireproof laboratory buildings, which, it is estimated, will cost about $200,000.

DIFFICULTY OF RETAINING EXPERTS.

One of the problems constantly recurring to the head of the Department is the difficulty of retaining in the service some of the most capable and efficient of its workers. During the past year three valuable workers were lost to the Department, and other losses are threatened, owing to the tempting offers made to Department experts from other sources. The Secretary recommends that Congress place it in his power to exercise a wider discretion in the matter of salaries to responsible officers.

ARLINGTON FARM.

Under the authority of Congress work has been begun on the Arlington estate with a view to establishing an experimental farm on the land set apart for the use of the Department.

DOMESTIC SILK CULTURE.

In 1899 the United States paid over $32,000,000 for imported raw silk, and in 1900 over $45,000,000. The Secretary believes that a large amount of cheap and now unemployed labor among the colored youth in the Southern States could be made available for domestic silk culture; and he desires an appropriation of $10,000 to set on foot research regarding the production of silk, to the end that the money now paid to foreign labor be distributed at home.

*STANDARD METHODS OF WATER ANALYSIS.**

As its first report of progress, the Committee on Standard Methods of Water Analysis presents the results of a careful inquiry into the present status of this general subject. This step was deemed necessary in order to bring to the Committee needed information for its guidance in its future plans of action.

About 125 copies of a circular letter, with an accompanying list of questions, were sent to leading workers. The number of detailed replies was fewer than should have been the case. Nevertheless, these replies, with the knowledge which the members of this Committee have as to the methods used in the more prominent laboratories, enable us to present a substantially correct *résumé* of existing conditions, as given in the following pages.

Collection of Samples.—Upon the subject of collection of samples the replies to the question sent to various workers were practically unanimous, and may be summarized as follows:

Bottles for chemical samples should have a capacity of one gallon, should be made of clear white glass in order to facilitate inspection, and should have glass stoppers. They should be washed each time before use with sulphuric acid and potassium bichromate, or with alkaline permanganate, followed by sulphuric acid; they should then be thoroughly rinsed and drained. For shipment the stoppers and necks of the bottles should be protected with cloth tied over them. They should be packed in cases with separate compartments for each bottle, and lined with indented fiber paper, felt or some similar substance, or provided with

* Report presented at the Indianapolis meeting of the American Public Health Association by a committee comprising Mr. George W. Fuller, chairman; Mr. George C. Whipple, secretary; Mr. Harry W. Clark, Dr. Adolph Gehrmann, Dr. Wyatt Johnston, Dr. E. O. Jordan and Dr. H. L. Russell.

corner spring strips to prevent breaking. The packing boxes should be covered and provided with suitable fastenings.

Bottles for microscopical samples should have a capacity of at least one quart, and should be of clear white glass, but they need not have glass stoppers. Bottles for bacterial samples should have a capacity of at least four ounces and should have wide mouths and glass stoppers. Before use they should be washed as described above, and then sterilized with dry heat for one hour at 160 degrees C., or in an autoclav at 115 degrees C. for fifteen minutes. For transportation they should be wrapped in sterilized cloth, or the neck should be covered with tinfoil and the bottles put in a tin box. When bacterial samples must of necessity stand for more than twelve hours before plating, it is preferable to use larger bottles than four ounces. The gallon bottle used for the chemical sample may be sterilized and used for the entire analysis. When samples are not plated at the time of collection, they should be kept on ice at not less than 10 degrees C. Portable ice-boxes with separate compartments for the ice and bottles may be sent by express with satisfactory results.

The allowable time that may elapse between the collection of a sample and the beginning of its analysis cannot be stated definitely, as it depends upon the character of the sample and other conditions, but the following limits are generally safe:

Chemical analysis.—For fairly pure surface waters, 24 to 48 hours; and for normal ground water, 48 to 72 hours. Polluted water requires analysis within twelve hours.

Microscopical examination.—For fairly pure waters, 24 hours. If fragile organisms, such as Uroglena, Synura, etc., are present, immediate examination may be necessary.

Bacteriological examination.—Immediate plating is always best, but seldom practicable. With fairly pure waters packed in ice, plating within 12 hours after collection will not introduce errors sufficient to vitiate the results.

Physical Examination.—The physical examination includes observations of the temperature, general appearance, color, turbidity and the odor in hot and cold samples.

The temperature should be taken at the time of collection, and expressed, preferably Centigrade degrees, to the nearest 0.5 degree. For obtaining temperature of water at various depths the thermophone gives the most accurate results.

The general appearance of the water should be determined by inspection in strong light after standing several hours. Substances remaining in suspension are then classed as 'turbidity on standing,' and substances settling to the bottom, as 'sediment.' The terms, none, very slight, slight, distinct, decided, etc., may be used for general work as described in the reports of the Massachusetts State Board of Health Where methods are used for expressing the turbidity and suspended matters numerically, as is necessary with sewage and some waters in some lines of work, the description of appearance may be omitted.

At the present time there is no uniformity in the methods of measuring turbidity or suspended matter. The wire method, the disk method, the diaphanometer method, the gravimetric method, and the use of standards of comparison all appear to have their field of usefulness. It is desirable that some system should be adopted for making the results by the various methods comparable, at least for those lines of work of the same general nature. In the absence of the necessary experimental data, your Committee is unable to make a definite recommendation at present, although studies now in hand will probably make this possible another year.

For measuring the amount of dissolved coloring matter in waters, the platinum-cobalt scale appears to be very generally used, although the Nessler and natural water standards and other methods are being used in important work. While the platinum standard does not appear to be wholly satisfactory, especially for very dark-colored waters, it appears to be generally suitable for ordinary use and serves well as a basis of comparison for all results. Your committee recommends that whenever any other method is used for color measurement, the relation of this method to the platinum standard shall be indicated. In the case of waters which are appreciably turbid, the suspended matters should be removed before determining the color which relates strictly to soluble matters.

The odor should be observed in both hot and cold samples, and the results recorded in terms expressing quality and intensity, substantially as described in the paper on this subject presented to this Section last year. (*Transactions* A. P. H. A., 1899, p. 587.)

Microscopical Examination.—The modified Sedgwick-Rafter method appears to give general satisfaction. The majority of analysts express the results in 'Number of Organisms per Cubic Centimeter,' but those who have had the largest experience with the method prefer to express the results in 'Number of Standard Units per Cubic Centimeter.' Inasmuch as the latter method takes into account the size of the various organisms, and may also be used for the amorphous matter, your Committee favors the general adoption of the standard unit method.

Chemical Analysis.—So far as your Committee has been able to learn, the chemical methods used for an ordinary sanitary analysis of a water do not vary very materially in those laboratories where most of this work is now being done. As a rule, the differences which are found appear to be justified by the differences in the nature of the waters and the objects of the work. It appears, however, from general observation, that there is room for improvement in a number of laboratories in which water analyses are made in small numbers and at irregular intervals. The determinations which from general opinion are considered necessary for a satisfactory sanitary analysis of an ordinary water are as follows: residue on evaporation, total and dissolved, with the loss on ignition in some instances; nitrogen as albuminoid and free ammonia, nitrites and nitrates; oxygen consumed; chlorine, and hardness. The general consensus of opinion regarding these determinations is quite harmonious on the whole, and the best current practice may be outlined in brief terms as given beyond.

Within the past few years water analysts have had occasion to study types of water about which very little was known a few years ago, and to assist in a variety of special problems relative to water pollution and various processes for the purification of both water and sewage. Such investigations have naturally resulted in an increase in our knowledge concerning a number of analytical matters, about which there was comparatively little known, in practical terms, in this country, a dozen years ago. Among the analytical methods relative to these studies, of a more or less special nature, may be mentioned those for alkalinity, iron, sulphuric acid, carbonic acid and dissolved oxygen. While the methods for these and other determinations have been carefully worked out with reference to certain conditions and waters of certain types, it is felt by the Committee that there are a number of details which can to advantage be left in abeyance until another year. The general trend relative to these so-called special methods is outlined briefly beyond.

With regard to the limits of accuracy of the several methods under various conditions, the determinations which can be best applied to various problems, the expression of the results of analysis and the interpretation of their results are all matters upon which the Committee has nothing to say until a further expression of experience and views is received from members of the Section.

Residue on Evaporation.—The amount of water used should be preferably such that the residue will weigh from three to twelve milligrams, although with sewages a greater weight is allowable. Experience alone can indicate the volume of water to be taken. Relative to dissolved residue, the suspended matter can be satisfactorily removed from surface waters of the glacial drift formation and from sewages by filtration through filter paper. The sub-microscopic clay particles of the Southern and Western waters can be best removed by a small Pasteur filter. This is not wholly satisfactory, as in some instances dissolved matters are absorbed by the filter, and in other cases they are removed from those stored in the filter. On an average it yields fair results, and no improvement can be suggested at this time.

With regard to the use of sodium carbonate, practice varies, but it would seem to be wise to add it (with a deduction from total weight) in those waters and sewages in which it is of value to obtain the loss on ignition. Evaporation is almost invariably obtained in a steam bath at a temperature of nearly 100 degrees C. The loss on ignition, it is believed, can be secured best with the use of a radiator in accordance with Drown's suggestions, although this device is not in general use. In fact, there is a growing tendency among workers to omit this determination, except for sewages and those waters relatively high in organic matter.

Chlorine.—This is determined always by titration with a standard solution of silver nitrate, using potassium chromate as an indicator. Colored surface waters first require decolorization by the addition of aluminum hydrate. The volume of water to be taken depends, of course, upon the amount of chlorides present. With unpolluted surface waters in the East, from 200 to 250 cubic centimeters should be concentrated by evaporation. In the case of sewages and highly polluted water containing much organic matter, satisfactory results can be obtained by evaporation to dryness, ignition of the residue and subsequent solution of the chlorides with hot, distilled water. The titration should be regularly made with volumes substantially the same as employed in the standardization of solutions.

Nitrogen as Free and Albuminoid Ammonia.—The volume of ordinary water taken for distillation is 500 cubic centimeters, and with very highly polluted waters or sewages smaller quantities are taken and diluted to the above amount with ammonia-free distilled water. Where many sewages are analyzed the volume taken may be 10 cubic centimeters or less, in accordance with Hazen's method. As a general rule, it seems advisable to add a few drops of a saturated solution of sodium carbonate before distillation. It is advisable to collect the distillate in the Nessler tubes in which this color is to be read. The rate of distillation should be 50 cubic centimeters in 5 or 6 minutes. It is an almost universal custom to collect three tubes of 50 cubic centimeters each, for the free ammonia, and five tubes for the albuminoid ammonia. In regard to the preparation of alkaline permanganate and Nessler solutions, the directions in any good text-book may be followed, and the individuality of various workers in these particulars is apparently not a factor affecting unfavorably the accuracy of results. Both the distillates and

the standard ammonia solutions should be of the same temperature before the addition of the Nessler solution.

Nitrogen as Nitrites.—No method superior to the Warrington modification of the Gness method is now known (see page 527, Special Report, Mass. State Board of Health, 1890, Part II.).

Nitrogen as Nitrates.—The determination of nitrogen as nitrates is made almost exclusively by two methods, the phenol-sulphonic acid method of Grandval and Lajoux, and the aluminum reduction method. With waters comparatively high in nitrates, and if a good brand of nitrogen-free caustic soda can be obtained, the aluminum method is more easily worked, and gives better average results. With waters low in nitrates and low in chlorine, the phenol-sulphonic acid method gives as good or better results than the reduction method. It is intended to consider the comparative merits of the two methods in detail in the later report.

Oxygen Consumed.—Practice varies widely both here and abroad with reference to the method for this determination; and many analysts omit it from the analyses of certain types of water. For sewages and those waters which are high in organic matter it undoubtedly yields valuable information. It would appear advisable to adopt a uniform procedure intermediate between the wide extremes now practiced. Such would be afforded by the addition of the reagents to the water when cold, and boiling for five minutes.

Hardness.—For ordinary sanitary work the soap method is commonly used, and for the soft Eastern waters it appears to give reasonably satisfactory results. For the hard waters of the West, Hehner's acid method is preferred. There are some details connected with the determination of the permanent hardness by the Hehner method which require further study.

Alkalinity.—This determination can be satisfactorily made by Hehner's method. Methyl orange is used by some workers as an indicator, while recent comparative studies give the preference to lacmoid or erythrosine. The latter indicators have the advantage, in connection with the use of coagulants, of affording the most reliable test for the presence of undecomposed alum in water.

Relative to the latter point, the logwood test is considered satisfactory by some workers, while by others it seems to be more of a qualitative test than a quantitative one. The differences in opinion are very likely due to unappreciated differences in manipulation which require further study.

Iron.—There are evidently several methods of an allied nature which can be used successfully for this determination, provided they are carefully applied. In another report the Committee can probably give a graded set of procedures, applicable to various conditions of practice. Thompson's method as described in Sutton's 'Volumetric Analysis' appears to be most generally used.

Sulphuric Acid.—Wildenstein's method as described by Ohlmuller has proved very satisfactory for certain lines of work, and preferable to the gravimetric method. Whether or not this is true under a wide range of conditions remains to be seen.

Carbonic Acid.—For Eastern waters Pettenkofer's method as described by Sutton is considered to be generally satisfactory; while for the Western waters Trillich's modification of this method, as described by Ohlmuller, is preferred by some workers. This method gives both the free and half-combined carbonic acid. There is a growing tendency among chemists to attach the more importance to the free carbonic acid alone. This can be obtained differentially by the method by which the free carbonic acid is removed, by the passage of the water

through a tube containing small gravel stones, with a current of air drawn in the opposite direction. Further study of this entire subject will place it on a more substantial basis.

Dissolved Oxygen.—There appear to be several methods which can be used successfully for this determination. The method in most general use, however, is that of Winkler as described in the Special Report of the Massachusetts State Board of Health, 1890, Part I.

By way of general comment it may be added that recent developments in sewage purification have indicated the desirability of special attention to several matters. Among them is the advantage coming from a more general use of the determination of suspended matters in sewage, with the loss on ignition. Another point is the desirability of determining the organic nitrogen in unpurified sewage by the Kjeldahl method, in view of the varying percentage of this constituent which is afforded by the albuminoid ammonia. The so-called 'incubation test' to show the relation to putrefaction of sewage after purification seems to have much practical value, under certain conditions, although the details cannot be considered at this time.

Quantitative Bacterial Examinations.—With reference to this subject, there has recently been a marked improvement in the general results obtained in this country. It is true, however, that methods of different workers are still variable to a degree which seems unnecessary, and which is certainly not desirable, when we consider that the value of this class of data relates largely to purposes of comparison.

The culture medium now in general use is nutrient gelatine, prepared substantially as recommended by the Bacteriological Committee in their Report of 1897. Meat extract, however, is still used by a number of workers, in place of meat infusion. Data are lacking to justify this as a general procedure. For some special lines of work nutrient agar is used with apparent advantage. These conditions refer to analyses of decomposed or stale sewage, where the number of bacteria capable of rapid liquefaction of gelatine is very large; and also to certain lines of field work. Several investigators have tried media of modified composition, containing new ingredients in some instances, but the present evidence is altogether too inconsistent and indefinite to permit of any recommendations along this line.

Concerning the reaction of the nutrient gelatine, the optimum varies under different conditions. Speaking in general terms, the majority of waters now studied appear to require ordinarily about 1.0 per cent. acid. There are some waters for which this reaction is too acid, and the sewage of some manufacturing cities evidently requires an alkaline medium. For important continuous work the reaction to be used should be carefully worked out with reference to the local conditions.

The amount of agitation which the sample of water should receive before plating, in order to insure mixing and a separation to a reasonable degree of groups of bacteria, is afforded by 25 vigorous shakes of the partially filled sample bottle.

Most workers arrange, so far as practicable, to have not more than about 200 colonies on the ordinary plate, such as Petri dishes having a diameter of about 4 inches. For those waters in which such numbers of Bacteria are contained in small fractions of one cubic centimeter, it is the general practice to dilute them with sterilized water, rather than to use pipettes delivering small fractions of one cubic centimeter.

The amount of nutrient gelatine used for each plate ranges at different laboratories from 5 to 10 cubic centimeters. Most workers use more than 7, while in some of

the largest laboratories the quantity is 5 cubic centimeters. For results to be obtained after four or more days of cultivation, the larger quantity is doubtless preferable. For results to be obtained after two days' growth, 5 cubic centimeters are found to be more satisfactory.

Practice varies with reference to mixing the water and the gelatine in the tube or on the dish, in those cases where Petri dishes are used. There is no evidence to indicate that this is a point of much practical significance, affecting results beyond the ordinary limits of accuracy.

With regard to standard conditions of cultivation, the best available evidence shows that it should take place in the dark and in an atmosphere in which moisture and oxygen are always present. Petri dishes sometimes fit too tightly to give satisfactory results, and special attention is necessary to these particulars. The temperature of cultivation should be uniformly 20 degrees C., and it is gratifying to note that in many laboratories this standard has been adopted, notwithstanding the care and expense which it sometimes involves.

The period of cultivation still varies considerably in the different laboratories. There is a well-defined movement, however, toward shorter periods in order to secure greater practical value for the data. These practical advantages outweigh the smaller numbers obtained from a shorter period, especially as all results have only a relative and not an absolute value. In Germany 48 hours is the standard period of cultivation, and daily results have been obtained on this basis from each of 26 water purification plants in operation in that country. There seems to be no good reason why the bacterial results to be obtained from the various water purification plants now in operation and about to be built in this country should not be comparable with those obtained abroad. This is especially true in view of the growing appreciation of the fact that the residual numbers of bacteria in a filtered water should receive attention as well as the percentage of bacterial removal. Taking everything into consideration, it would appear to your Committee to be advisable to adopt 48 hours as a standard period of cultivation under the conditions noted above. Before making a final recommendation there is requested a further expression of opinion on the part of the members of the Section of Bacteriology and Chemistry.

Relative to the records of the numbers of bacteria per cubic centimeter, there are many workers whose custom is very loose and unscientific. Your Committee disapproves of customs which indicate a fictitious accuracy in current methods, by the inexcusable use of significant figures in the units place where the numbers are very high.

Differentiation and Classification of Species of Bacteria.—This branch of bacteriology is of much importance in connection with water analysis, because reliable and readily available methods for the detection of water-borne disease germs cannot be established until this general subject has been placed upon a more scientific and substantial basis. It is true, of course, that progress for a time along this line must be largely a matter of pure science, and that interest in these developments is shared not only among water analysts, but all workers in applied bacteriology.

Your Committee has made every reasonable effort to secure a consensus of opinion as to how this subject now stands, with reference to the soundness or weakness of the various current methods and procedures. While the views of a number of prominent workers, especially those not directly connected with water analysis, have not yet come to hand, it is believed that the general status of affairs may be correctly outlined as follows :

It is now universally recognized that the first requisite toward successful work in this field is the use of culture media of uniform standard composition. With the view to the accomplishment of this end, the methods of preparation of media recommended by the Bacteriological Committee in their Report of 1897 are in general use. Taken as a whole, they seem to have given, and to still give, general satisfaction. It is true, however, that in several laboratories these recommendations are departed from with regard to the manipulations which apparently affect but little the question of uniformity. Practice, furthermore, varies somewhat in a number of laboratories, with reference to the use of meat infusion as compared with meat extract; in the preparation of milk for a culture medium; and in the reaction of various media for species work. Each of these points requires attention.

Concerning those tests and procedures to be employed in order to secure diagnostic data in species work, it is plain that the recommendations of 1897 have caused material advances over previous methods. It is certain, however, that the 1897 Report in this respect has thus far met less support and approval than in the case of the preparation of culture media. The report has evidently set at work a leavening process in several places, and an improved state of affairs will presumably result in time. Why it is that with test after test there is a disagreement as to value among experienced workers is a matter which is not now understood, and which suggests unappreciated differences in procedures.

Relative to the results of those tests which are considered to be of differential value, and to the method of recording them, opinion is widely at variance. Some believe that they should be confined to those of a positive and definite nature. Other workers consider that they cannot be made too detailed and exhaustive.

In brief terms it may be said that, with regard to the general subject of species differentiation, a material step in advance has been taken in consequence of the Report of the Bacteriological Committee of 1897. As a result of the added knowledge coming to various workers through the general use of the 1897 Report as a guide, the time has arrived when that Report can and should be revised. Concerning the new evidence which has been obtained since that Report was prepared, it has not yet reached your Committee in a form adequate to allow changes to be recommended at this time. In fact, there are many indications which go to show that the amount of directly comparable evidence from the various laboratories is much less than is generally realized, owing to the wide variety in the nature of the species work now going on in this country.

In the opinion of your Committee the real issue for discussion to-day on this topic is not the question of detailed points of improvement, but rather the best general procedure by which species work can be elevated to a higher plane of excellence. This matter has received considerable thought from the Committee, and it would appear that as a first requisite it will be necessary to secure the cooperation of the workers in other branches of bacteriology. It would also appear to be necessary to secure comparable data upon corresponding cultures of the same species from a considerable number of experienced workers. Further, it would be very desirable if data from the same species could be obtained at the same laboratory with culture media prepared by a number of other investigators.

Fermentation Tests and the Detection of B. coli communis and other Specific Forms.—While these methods come within the scope of general species methods for bacteria, it is considered that they are entitled to separate consideration. This is due to the fact that

this subject is studied by many water analysts who do not attempt general species determinations, and to the further fact that upon these topics opinion is more crystallized than upon the general subject of species methods.

Relative to fermentation tests, this topic was considered at length by the Bacteriological Committee in the Report of 1897. The present status with reference to those recommendations may be outlined as follows:

In the preparation of fermentation solutions, the use of meat infusion as compared with meat extract is still an open question. Both are used. Opinion seems unanimous, however, that in either case they should contain no muscle sugar. It is generally considered that a reaction of 1.5 per cent. acid is not perfectly satisfactory, and most workers employ solutions which are practically neutral to phenolphthalein. The amount of sugar is 1 per cent. as a rule, as recommended, although it appears that glucose is used by many to the exclusion of lactose and saccharose. This latter tendency would seem to be a step in the wrong direction, for many lines of work. Opinion is at variance concerning the effect of heat upon these sugars in the course of the preparation of the solutions. Cultivations are made almost invariably at 37 degrees C. for a period of three days, with records daily as to the percentage of gas in the closed arm. In other particulars there are some differences in general practice, but they apparently are of little consequence in affecting results such as would be obtained by strict adherence to the procedures of the 1897 Report.

While considerable increase to our knowledge of the fermentation-produced bacteria has occurred within the past three years, there is not at present sufficient evidence at hand to recommend an improved set of procedures.

With regard to the isolation of *B. coli communis*, there are evidently quite a number of procedures which are used with success. These procedures differ somewhat on account of the wide range in natural conditions under which tests are made for this form in various waters. Where *B. coli communis* forms a small percentage of the total bacteria, the custom appears to have come into general use of employing a preliminary incubation to eliminate ordinary water bacteria. It is thought that it will not be a laborious task during the coming year to draft a graded series of acceptable methods to cover the wide range of conditions met with in practice.

It is gratifying to note a general uniformity in the characteristics considered essential to the identification of *B. coli communis*, as follows:

1. Fermentation of dextrose with the production of carbonic acid equal approximately to 33 per cent. of the total gas formed.
2. Coagulation of milk.
3. Non-liquefaction of gelatine, with growth at the surface and in the form of beads along the line of inoculation in a gelatine tube-culture.
4. Formation of indol.
5. Conformity to the main morphological characteristics of this type as published.

With reference to those forms resembling *B. coli communis*, which ferment sugars with the production of carbonic acid varying widely from 33 per cent. of the total gas, it is now generally regarded that they should not be reported as *B. coli*. What their true relation is to this species, and what their sanitary significance is relative to the character of waters in which they are found, are questions which cannot be answered satisfactorily at present.

Very few, if any, experienced bacteriologists engaged in public health work make a practice of attempting to isolate the ty-

phoid bacillus or any specific forms other than *B. coli communis*. For obvious reasons it is inadvisable at this time to give this phase of water analysis any detailed consideration.

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*SUNSPOTS AND RAINFALL.**

AT the meeting of the Royal Society on November 22d, Sir Norman Lockyer and Dr. W. J. S. Lockyer presented a paper on 'Solar Changes of Temperature and Variations in Rainfall in the Region Surrounding the Indian Ocean.'

Sir Norman Lockyer, who made the communication, said the fact that the abnormal behavior of the widened lines in the spectra of sunspots since 1894 had been accompanied by irregularities in the rainfall of India, suggested the study and correlation of various series of facts that might be expected to throw light on the matter. Among the conclusions thus arrived at were: (1) A discussion of the chemical origin of lines most widened in sunspots at periods of *maxima* and *minima* indicated a considerable rise above the mean temperature of the sun around the years of sunspot *maximum* and a considerable fall around those of sunspot *minimum*. (2) From the facts of rainfall in India (during the southwest monsoon) and Mauritius between the years 1877 and 1886, as given by Blanford and Meldrum, the effects of these solar changes were seen to be felt in India at sunspot *maximum* and in Mauritius at sunspot *minimum*, the greater effect being in Mauritius. The pulse in Mauritius at sunspot *minimum* was also felt in India, giving rise generally to a secondary *maximum*. India, therefore, had two pulses of rainfall, one near the *maximum* and the other near the *minimum* of the sunspot period. (3) The dates of the beginning of these two pulses in the Indian and Mauritius rainfall were related to the sudden remarkable changes in the behavior of the widened lines. (4) All the famines recorded in the Famine Commission reports as having devastated India during the last half-century occurred in the intervals between these two pulses. (5) Investigation of the changes in (*a*) the widened lines (*b*) the rainfall of India, and (*c*) the rainfall of Mauritius during and after the last *maximum* in 1893 showed in all three important variations from those exhibited during and after the last *maximum* of 1883. The *minimum* of 1888–89 resembled the preceding *minimum* of 1878–79. (6) From 1849–1878 the lowest Niles recorded occurred between the same intervals. (7) Although the relations of these intervals to the droughts of Australia and of Cape Colony, and to the variations of rainfall in extra-tropical regions generally, had not been investigated, a general agreement had been made out between the intervals and the rainfall of Scotland, and both pulses had been traced in the rainfalls of Cordoba and the Cape of Good Hope. (8) The results of the inquiry having been placed before Mr. John Eliot, Meteorological Reporter to the Indian Government, he gave it as his opinion that they accorded closely with all the known facts of the large abnormal features of the temperature, pressure, and rainfall in India during the last twenty-five years, and that hence the inductions already arrived at would be of great service in forecasting future droughts in India.

When the image of a sunspot was thrown on the slit of a spectroscope, examination of the spectrum indicated that the blackness of the spot was due not only to general but also to selective absorption, and that the lines widened by the selective absorption varied from time to time. From many years' observations of these widened lines it appeared that at some periods they were distinctly traceable to known elements, while at others their origins had not been

* From the London *Times*.

discovered and they were classed as unknown lines. Comparison of these two periods, with the sunspot curve as constructed from the measurements of the mean spotted area for each year, indicated that when that area was greatest the widened lines belonged to the unknown class, but when it was least to the known class. Now, in the laboratory it was possible to differentiate between three stages of temperature—that of the flame, of the electric arc and of the electric spark of the highest tension. At the lowest temperature—that of the flame—a certain set of lines was obtained; as the temperature of the arc was reached a new set was seen; and at the temperature of the high tension spark other lines, called enhanced lines, were added, while many of the arc lines waned in intensity. At sunspot *minimum*, when the known lines were most numerous, the lines were almost invariably those seen most prominently in the arc. But as the *minimum* passed towards the *maximum* the unknown lines gradually obtained the predominance, and these were possibly 'enhanced' lines, indicating the action of a much higher temperature on known substances. It was therefore justifiable to assume a great increase of temperature at the sunspot *maximum* where these unknown lines appeared. The curves of the known and the unknown lines had been obtained by determining for each quarter of a year the percentage numbers of the two kinds, and plotting them as ordinates with the time elements as abscissæ. But for the purposes of the investigation, instead of using the mean curves of all the known elements involved, that for iron alone was employed, since that metal was a good representative of the known elements, and had been most fully studied. Such curves when drawn crossed each other at points where the percentage of unknown lines was increasing and that of iron or known lines decreasing, and *vice versa*. There seemed, therefore, to be three well-marked stages of solar temperature. At the crossing points, where the numbers of known and unknown lines were about equal, a mean condition might be assumed, a *plus* pulse or condition of temperature being indicated when the unknown lines reached their *maximum*, and a *minus* pulse when the known ones reached their *maximum*. The curves obtained during the last 20 years endorsed the conclusion that the unknown lines curve varied directly and the iron-lines curve inversely with the sunspot area. The widened-line curves were quite different from those furnished by the sunspots. The crossings were sharply marked, and since 1879 three of them had occurred, indicating the presence of mean solar temperature conditions in 1881, 1886-87, and 1892; another such crossing was anticipated in 1897, but has not as yet taken place. Sunspots were indications of excess, not of defect, of heat, and it was now known that the spots at *maximum* were really full of highly heated vapors produced by the prominences, which were most numerous when the solar atmosphere was most disturbed. The Indian meteorologists had abundantly proved that the increased radiation from the sun on the upper air currents at *maximum* was accompanied by a lower temperature in the lower strata, and that with this disturbance of the normal temperature pressure changes must be expected. Chambers was the first to show that large spotted area was accompanied by low pressures over the land surface of India. To pass from the consideration of individual spots to the zones of prominences with which they were probably associated, it was of the highest interest to note the solar latitudes occupied when the crossings already referred to took place, as in this way were discovered the belts of prominences which were really effective in pro-

ducing the increased radiation. The area of these being much larger a considerable difference of radiation might be expected —a fact it was all the more necessary to point out, because the insignificance of the area occupied by the spots had been used as an argument against any easily recognized connection between solar and terrestrial meteorological changes. Assuming two belts of prominences north and south 10° wide, with their centers over latitude 16°, one-sixth of the sun's visible hemisphere would be in a state of disturbance.

The authors' object in studying rainfall was to ascertain whether the *plus* and *minus* temperature pulses in the sun were echoed by *plus* and *minus* pulses of rainfall on the earth. The rainfall tables published by the Indian Government were first studied with special reference to the southwest monsoon, and it soon became evident that in many parts of India the *plus* and *minus* conditions of solar temperature were accompanied by *plus* and *minus* pulses producing pressure changes and heavy rains in the Indian Ocean and surrounding land. These occurred generally in the first year following the mean condition—viz., in 1877–78 and 1882–83, dates approximating to, but followed by, the *maximum* and *minimum* periods of sunspots. It was especially in regions such as Malabar and Konkan, where the monsoon struck the west coast of India, that the sharpness and individuality of these pulses were the most obvious. The study of Eliot's table of the rainfall of all India from 1875 to 1896 revealed predominant pulses in 1889 and 1893, following those of 1877–78 and 1882–83, so that it enabled the working of the same law—of the mean solar temperature being followed by a pulse of rainfall—to be traced through another sunspot cycle. The 'whole India' curve between 1875 and 1896 was also used to test whether the sun pulses, which were found to be bound up with the Indian rainfall, were in any way related to the variations often pointed out in the snowfall on the Himalayas; it was found that the values occurring at the *plus* and *minus* pulses were among the highest. Hence it appeared that the quantity both of rain and snow was increased in the years of the rise both of the unknown and of the iron lines. For the Mauritius the rainfall curve, plotted from 1877 to 1886, was seen to be fairly regular, showing alternately an excess and a deficiency of rainfall. The highest points of the curve were reached in 1877 and 1882, the lowest in 1880 and 1886. Thus the *maximum* rainfall of 1877 occupied about a year after the rise of the known lines in 1876, while the next pulse of rainfall in 1882 followed the succeeding crossing when the unknown lines were going up, also about a year later. The curves expressing the rainfall for the Cape and Cordoba for the same period showed two prominent *maxima* in the years 1878 and 1883, corresponding nearly with the *plus* and *minus* pulses of solar temperature. On comparing them also with the Bombay and Mauritius curves for the same period, it was found that the pulses indicated at Bombay occurred simultaneously with those of 1878 and 1883, but in Mauritius the effect of each of the pulses was felt a year or so earlier—namely in 1877 and 1882. The rainfall curve for Batavia for this period had its prominent *maximum* in 1882, as in Mauritius, thus preceding by a year the pulse felt at the Cape, Cordoba and Bombay in 1883.

Unless the pulses either overlapped or became continuous, there would obviously be intervals between the ending of one and the beginning of another. The *plus* and *minus* pulses, to which attention had chiefly been directed, were limited in duration, and when they ceased the quantity of water falling in the Indian area was not sufficient without water storage for the purposes of agriculture. They were followed, therefore,

by droughts, and subsequently, at times by famines. Thus, taking the period from 1877 to 1889, there was rain from the *minus* pulse in 1877–78–79 (part); no rain pulse in 1879 (part)–80–81 (part); rain from *plus* pulse 1881 (part) 82–83–84 (part); no rain pulse in 1884 (part)–86–87; and rain from the *minus* pulse in 1887 (part)–88–89. All the Indian famines since 1836 had occurred in these intervals, carried back in time on the assumption of an 11-year cycle. Thus, taking 1880 as the central year on the ascending curve, it was itself a year of famine in Madras and the North-West Provinces; also

1880 — 11 = 1869, N.W.P. famine (1868–69)
1869 — 11 = 1858, N.W.P. famine (1860)
1858 — 11 = 1847,
1847 — 11 = 1836, Great famine in Upper India (1837–38). Again, taking 1885–1886 as the central years on the descending curve :—

1885–86, Bengal and Madras famines (1884–85)
(1885–86)—11=1874–75, N.W.P. famine (1873–74)
Bombay famine (1875–76)
Bombay and Upper India famines (1876–77)
(1874–75) — 11 = 1863–64, Madras and Orissa famines (1865–66)
(1863–64) — 11 = 1852–53, Madras famine (1854).

It was clear from this table that if as much had been known in 1836 as was known now, the probability of famines at all the subsequent dates indicated might have been foreseen. The dates might also be carried forward from 1880; thus—

1880 + 11 = 1891, N.W.P. famine (1890)
Madras, Bombay and Bengal famines (1891–92)
(1885–1886) + 11 = 1896–97, General famine.

Famine years in India were usually years of low flood in Egypt, and it might be pointed out that the highest Niles followed, at an interval of one or two years, the years of the *plus* and *minus* pulses. As to the great Indian famine of last year, the widened line curves, so far from having crossed in 1897 or 1898, as they ought according to the few precedents available, had not crossed even now; in other words, the condition of ordinary solar mean temperature had not even yet been reached. Now India in a normal cycle was supplied from the southern ocean during the *minimum* sunspot period, and the rain was due to some pressure effect brought about in high southern latitudes by the sun at *minus* temperature. But as this temperature condition was not reached in 1899, as it would have been in a normal year, the rain failed. Thus the only abnormal famine recorded since 1836 occurred precisely at the time when an abnormal effect of an unprecedented *maximum* of solar temperature was revealed by the study of the widened lines.

THE ULKE COLLECTION OF COLEOPTERA.

The collection of Coleoptera brought together during the last 50 years by Henry Ulke, of Washington, D. C., has been purchased by the Carnegie Museum, of Pittsburgh, Pa.

Henry Ulke, artist, musician, entomologist—a noticeable character from many points of view—having passed beyond his eightieth birthday, has given up his entomological collections, but by no means his interest in this branch of science. The writer met him the other day in Washington, active, alert, clear-eyed, with a complexion like a child's, and asked him how it was that he retained his youth at 10 years beyond the allotted space of life. The reply was wittily characteristic and contained a characteristic truth: "In the first place," said Ulke, "I was very careful in my choice of parents; and in the second place, my love of Nature has kept me constantly in the woods and fields throughout all my life."

The Ulke collection of Coleoptera is one of the largest and, historically and in other

ways, one of the most important collections in the United States. It represents the life-long work of one of our most experienced and most assiduous collectors. Its foundation dates back nearly half a century, and up to within the past few years Mr. Ulke spared no effort to increase it by collecting or by exchanging. In the early days of the great transcontinental surveys, the Smithsonian Institution had not begun to make collections of insects, and as a result much of the material picked up by the naturalists connected with these surveys fell into Mr. Ulke's hands. He was never a publishing entomologist, and the writer believes that only one published paper bears his name. That was a report on the beetles collected by one of the Wheeler survey expeditions. The collection numbers perhaps 125,000 specimens, and its large number of species—more than 11,000—as well as the large series of specimens representing each species, rendered this collection for many years preeminent among other collections. It is, in fact, only within the past 15 or 20 years, when careful collecting methods have become more generally adopted and when railroads have made all parts of the country more accessible, that other large private collections have been formed. Ulke early appreciated the importance of large series, and at a time when other collectors were gathering beetles as a boy collects postage stamps, one or two specimens representing a species, Ulke had his long rows of specimens indicating variation within specific limit and variation due to geographic and other environmental dissimilarities.

A distinguishing feature of the collection is the uniformly perfect preservation of the specimens as well as the exquisite and painstaking care with which even the most delicate specimens are prepared and thus rendered available for study. In this respect the collection is still unapproached by any other.

How much the progress of North American coleopterology is indebted to this collection can readily be seen from the writings of systematists, and in fact there is not a single worker in this field who has not drawn material from the Ulke collection. The liberality with which Mr. Ulke has always placed his collection at the disposal of students and workers is well known and has been acknowledged in print over and over again. The collection was employed by Le Conte and by Horn in the preparation of their various monographs and revisions, and has been similarly used by Dietz, Hayward, Matthews and others. That the collection has thereby been increased in scientific value goes without saying and besides a large number of actual types the collection contains several thousand specimens which are cotypical in value.

The Carnegie Museum, at Pittsburgh, already contains the collection of Coleoptera of the late Dr. John Hamilton, and it is sincerely to be congratulated upon this last important addition to its entomological treasures. This is the first time, I believe, that a private collection made in our Eastern States finds its way west of the Allegheny Mountains, and while the writer sincerely regrets that the collection could not remain in Washington as the property of the U. S. National Museum, he feels consolation in the firm conviction that it will be well cared for at Pittsburgh, at least so long as Dr. Holland remains Director of the Carnegie Museum (and may that be for many years to come!), and will continue to to be a source of information and study for the younger generation of coleopterists.

The Museum also contains, as is well known, the superb collection of Lepidoptera brought together by Dr. Holland, and this last collection cannot fail to place the Carnegie Museum in a group of four public institutions which contain collections of insects of great extent and value and

which will be consulted by students for generations to come. The other three great collections are to be found at the Museum of Comparative Zoology, at Cambridge, Mass.; the Academy of Natural Sciences, at Philadelphia, Pa.; and the U. S. National Museum, Washington, D. C.

L. O. Howard.

SCIENTIFIC BOOKS.

American Hydroids, Part I, The Plumularidæ. By C. C. Nutting. Washington, 1900. Published by the Smithsonian Institution. Pp. 285; pls. 34.

We are accustomed to think of social life and the division of labor as being especially characteristic of highly organized beings, such as ourselves among the vertebrates, and the ants among the arthropods; but as a matter of fact socialism was invented and put into practice very early in the history of terrestrial life, among creatures not so very far removed from the most primitive types known to us. Professor Nutting, in the splendid monograph now under review, tells us (p. 46) that "Hydroids are exceedingly low in their organization and exhibit in several respects the appearance of loosely aggregated assemblages of cells which are individually much like protozoa," and yet he describes and figures the wonderfully differentiated individuals or 'persons' which make up the beautiful and complicated feather-like colonies of these animals. That there would be some differentiation for reproductive ends we might well expect, but the Plumularidæ keep a standing army of remarkably constituted individuals, supported by the common purse, and fighting for the common weal. Listen here to Professor Nutting:

"As to the morphological significance of the sarcostyles, all of the more recent authorities, except Jickeli, regard them as degenerate individuals of the colony, or as 'fighting persons.' That they are individuals or 'persons' is a matter hardly admitting of doubt; but it may well be questioned whether they are *degenerate* persons or not, and an argument might be constructed which would go to show that instead of being degenerate individuals they are in fact very highly specialized persons. Specialization is indicated when the structure has departed from the original type in order to become adapted to more definite and exclusive function. It would seem that the sarcostyles have done this very thing—departed from the original type (*Protohydra?*), and become morphologically differentiated into individuals having the definite function of defense, in most cases, and of prehension by means of adhesive cells in others" (p. 28).

All of which teaches us that, after all, living protoplasm is *the* wonderful thing; granting it, the varied and complicated manifestations of life may be said to follow naturally and inevitably, their extent and variety dependent on warmth and moisture, time and space, but their essential nature what it was when life first appeared upon the earth.

These things may sound trite; but while we talk glibly of differentiation and evolution, we do not always descend from the abstract to the concrete, and realize the actual facts. Professor Nutting's monograph should have this value to the general zoologist and the teacher of science, that it brings them as nearly into contact with the things themselves and their way of life as may be possible without a prolonged and special study of the group. The study of types may give us a certain knowledge of structure, but without a real insight into life-histories, we miss most of the fun, and may therefore be thankful to be invited to partake of the provender so laboriously gathered for our benefit.

In 1862, the elder Agassiz recognized only three Plumularidæ from the coasts of the United States. To-day Professor Nutting makes us acquainted with 121 American species, eight of which, however, are not found north of the Isthmus of Panama. Of the 121, no less than 52 have been first made known by Professor Nutting himself. Most of the species come from the West Indies, and it seems rather remarkable that only ten are reported from the whole Pacific coast of North America. Surely more careful collecting off the coasts of Southern and Lower California should bring to light a number of new forms.

T. D. A. Cockerell.

The Oil Chemist's Handbook. By ERASTUS HOPKINS, A.M., B.Sc., Chemist in charge of U. S. Laboratories, Boston, Mass. New York, John Wiley & Sons; London, Chapman and Hall, Limited. 1900. Pp. viii + 72.

This book is intended as a practical laboratory handbook for use in the examination of commercial oils and fats. Concise and satisfactory directions are given for the execution of the ordinary quantitative determinations which are made with materials of this class. The special and most valuable feature of the book, however, consists in the full tables which are given, and in their excellent arrangement. These include tables of general properties, solubility, adulterants and of constants. The tables of constants are duplicated by giving, first, a table arranged with reference to the oils, giving all of the important constants for each oil, and then tables for each constant, as saponification value, iodine value, Reichert-Meissl value, etc., with the oils arranged according to their numerical values for the given constant. The tables appear to have been prepared very carefully and the book is a very valuable one for those working in this field.

W. A. N.

The Calculations of Analytical Chemistry. By E. H. MILLER, Ph.D., Instructor in Analytical Chemistry and Assaying in Columbia University. New York, The Macmillan Co. 1900. Pp. 183.

As the author states in the preface: "This text-book is intended for use in scientific schools and colleges, in connection with courses in analytical chemistry, and aims to give a logical treatment of the calculations required by an analyst." "The object has been to furnish a text-book, which shall give the necessary information concerning those important chemical calculations which every student should thoroughly understand before taking up advanced work." "Formulæ have been avoided, except in the last chapters, so that the student shall consider each problem individually and solve it from a knowledge of chemical laws instead of substituting in formulæ for different cases."

The subjects taken up in this book are as follows: Calculations of chemical equivalents and atomic weights; of formulæ and percentage; of mixtures having a common constituent; calculations from equations; calculation and use of factors; calculations of volumetric analysis; of density of solids and liquids; of gases; of calorific power and electric and electrolytic calculations for direct currents. The method involved in each case is clearly explained with example, and a number of problems for solution are given in each chapter. The author has brought together here in a compact form some of the most important calculations of analytical chemistry. Much of the material would be inaccessible to a student or perhaps worked out from formulæ given without any explanation of the principles involved. A number of tables are also given of values used in the calculations.

J. E. G.

SCIENTIFIC JOURNALS AND ARTICLES.

The American Journal of Physiology, December, has as its leading article 'The Reactions of Planarians, with and without Eyes, to Light,' by G. H. Parker and F. L. Burnett. They found that planarians without eyes tend to turn away from their course when directed towards the source of light and to keep in it when directed away from the source. This reaction, however, is less precise than in planarians with eyes. Planarians with eyes move more rapidly than those without eyes, and those moving away from the light than those moving towards it. Anne Moore contributes a paper on 'Further Evidence of the Poisonous Effects of Pure NaCl Solution.' According to her investigations pure solutions of the chlorides of Na, Ca, K, Mg, and Li are poisonous. The poisonous effects of a pure NaCl solution may be antagonized by Ca, although Ca is not necessary in itself, for it renders a sugar solution more harmful. K does not antagonize Na, but may antagonize Ca used in small quantities. In weak solutions sugar is as poisonous as isosmotic solutions of NaCl, but in stronger solutions this is not true. Young trout and tadpoles live indefinitely in distilled water, and in salt solutions if Na and Ca ions are in balanced proportions. The 'Influences of Digestion on Animal Heat Processes' are presented in a study by E. T. Reichert. He

concludes that the rise of temperature during digestion (maximal about the fourth hour) is due to an increase of heat production. Since the greatest increase of heat production occurs during the first hour after feeding, the changes in heat production and temperature are not proportional. The most marked effects are produced from a proteid and fat diet, next with proteid alone, and least with fat. R. M. Yerkes continues his work on phototaxis with a study of the reactions of *Daphnia* and *Cypris*. A marked increase in rate of movement of *Daphnia* with increased intensity of light he ascribes to greater precision and quickness of orientation, and in part also to more rapid swimming. In *Cypris* this phenomenon is not so marked, a difference ascribable probably to the greater importance to *Daphnia* of orientation as a factor in rapid movement. Contact with the sides of a pipette appears to render a negative animal positive, but so far as observed the reactions do not change with changes in temperature. For the forms studied light is a sufficiently strong directive agent to lead them into fatal acid solutions.

The Journal of the Boston Society of Medical Sciences for October 23d is devoted to the important and interesting 'First Annual Report of the Cancer Investigation Committee to the Surgical Department of the Harvard Medical School.' This summarizes the investigations made during the past year through the bequest of Caroline Brewer Croft. In the 'Introduction,' by J. Collins Warren, the steady increase of cancer is noted, and the 'Statistics of Cancer,' by W. F. Whitney, show that their increase is about the same in New England and Great Britain. Edward H. Nichols gives an account of the work 'On the Etiology of Cancer,' in which he states that attempts to produce cancer in animals by inoculation with tissue from human cancer have so far uniformly failed and that no attempt to isolate an organism from human cancer has succeeded. R. B. Greenough has a 'Report on the Presence of Plimmer's Bodies in Carcinomatous Tissue,' showing that three bodies were present in each of thirteen cases. E. E. Tyzzer describes 'Tumors and Sporozoa in Fishes,' and Edwin A. Locke describes 'The Reconstruction in Wax of a Nodule of Cancer.' Oscar Richardson also has a 'Report of Culture Experiments made with Carcinomatous Tissue, 1899 and 1900,' which shows that he too was unable to obtain any trace of a specific infecting organism. The report is illustrated with a number of fine plates.

The American Naturalist for November is devoted to the invertebrates. W. M. Wheeler describes in detail 'A Singular Arachnid (*Kœnenia mirabilis* Grassi) occurring in Texas' and also 'A New Myrmecophile from the Mushroom Gardens of the Texan Leaf-cutting Ant,' to which the name of *Attaphila fungicola* is given. C. B. Davenport has a paper 'On the Variation of the Shell of *Pecten irradians* Lamarck from Long Island,' considering that those described are either self-adjustments to accidents or sports which represent typical conditions in allied species. A somewhat similar paper is that by Minnie Marie Enteman on 'Variations in the Crest of *Daphnia hyalina*,' in which the author shows that variation is confined to summer forms and that to some extent there is a local tendency to particular variations. Finally W. S. Nickerson discusses 'Double Loxosomæ,' considering that the cases noted were due to fusion and not fission.

The *Popular Science Monthly*, for November, reprints for its opening article, under the head of 'Oxygen and the Nature of Acids,' the paper 'On Dephlogisticated Air,' by Joseph Priestley and the 'Memoir on the Existence of Air in the Acid of Nitre; General Considerations on the Nature of Acids,' by Antoine Laurent Lavoisier. Simon Newcomb continues his 'Chapters on the Stars,' considering their masses and densities, gaseous constitution, and evolution. H. W. Conn discusses 'Microbes in Cheese-Making,' telling briefly what has been done and what remains to be done in the problem of cheese ripening. Under the title of 'Submarine Navigation,' W. P. Bradley gives an interesting account of the various craft that have been devised for that purpose with somewhat detailed descriptions of the *Argonaut* and *Holland*. George C. Whipple describes 'Municipal Water-Works Laboratories' showing the work that has been done by them and intimating that in

the future they will play an important part. George Stuart Fullerton discusses 'Freedom and Free Will' and William Barclay Parsons treats of 'Chinese Commerce' the gist of which is a plea for what every sensible man knows should exist, a permanent consular service. There are interesting articles under the head of 'Discussion and Correspondence,' 'Scientific Literature' and 'The Progress of Science.'

Bird Lore for December comes in an enlarged form and has for its frontispiece a fine photograph from life of a rough-legged Hawk. E. R. Warren describes, with a number of illustrations, 'Photographing Ptarmigans' and this is followed by an article on 'How Ptarmigans Moult,' by Jonathan Dwight, Jr., the best authority on that vexed subject. Bradford Torrey writes of 'Winter Pensioners.' The department 'For Teachers and Students' is devoted, under the caption 'Birds and Seasons' to the first series of papers giving an outline course of bird-study for the year, the present dealing with the months of December and January and with various part of the country from Boston to San Francisco, each article being by a well known authority on the subject. The other and shorter articles under the different departments are too numerous for individual notice, but the Audubon Department is of particular interest.

SOCIETIES AND ACADEMIES.

NEW YORK ACADEMY OF SCIENCES.

SECTION OF GEOLOGY AND MINERALOGY.

AT the meeting of the Section on October 15th, Dr. A. A. Julien in the chair, about thirty persons were present.

The Secretary of the Academy nominated for membership Riccardo Pattelli and Charles Lane Poor, and the names were referred to the Council.

The following notes on the results of the summer's work by members were presented:

Gilbert Van Ingen.—Paleozoic Faunas of Northwestern New Jersey.

Mr. van Ingen described the work of the party belonging to the Geological Survey of New Jersey, which, during the past two summers, has been engaged in tracing the outcrops of the paleozoic formations, and collecting fossils. Of this party, Mr. Kummel, the assistant State geologist, traces the boundaries and works out the tectonics, while Dr. Weller, of the University of Chicago, collects fossils at localities indicated by Mr. Kummel. During July, Mr. van Ingen spent a week with this party in the field at Newton. Newton is situated on the shales of the Trenton group, there extensively quarried for slates. To the east is a low ridge of limestone which presents the same appearance as the Barnegat limestone along the Hudson river. The upper part of this limestone has yielded trilobites, probably *Dikellocephalus*, indicating that this portion is of upper Cambrian age. At other localities a trilobite described by Weller as *Liostracus jerseyensis*, shows that the rock there is also Cambrian—probably of the middle or upper division. In the vicinity of Franklin Furnace good specimens of *Olenellus cf. thompsoni* were found at localities described by Foërste. Further to the east of Newton, on the other side of the Cambrian ridge, is a wide belt of Ordovician rocks—Trenton limestone overlaid by a thick series of shales. The limestone contains the typical Trenton fauna,—*Rafinesquina Plectambonites*, *Pterygometopus*, etc.,—and is very much like that found at Rosetown, Ulster Co., and Rochdale, Dutchess Co., N. Y. The shale has few fossiliferous beds, but occasionally one of the more sandy layers contains *Dalmanella testudinaria*, *Plectambonites* and *Rafinesquina*—the same combination found in the Hudson shales at Poughkeepsie and at Roundout. At one locality was found a fauna with *Ampyx* and *Harpes*. In eastern New York these genera of trilobites are found only in the Chazy limestone, and the discovery is of great interest in that it indicates the presence of this formation at a distance of almost 250 miles south of what has hitherto been recognized as its southern limit. Further to the northwest, along the Delaware river, were found the Silurian and lower Devonian formations. The finest section is seen in the face of the cliff of the old Nearpass quarry, about three miles south of Tri-States, where all the formations from the upper Ordovician to the Esopus shale of the lower Devonian appear, with numerous fossils. At Otisville the Shawangunk grit is finely exposed in a large quarry. All the evidence at hand

points to the conclusion that this formation, of a thickness of at least a thousand feet, was formed as a flood plain deposit. Its characteristics, except color, are the same as the New Jersey and Connecticut valley Jurassic sandstones. Ripple-marks, sun-cracks, cross-bedding, channel-fillings, etc., are abundant. In the railroad cut west of Otisville the grit lies upon Hudson shales, with non-coincident dip. On the contact occurs a few inches of clay, which next to the shale, is quite free of pebbles, while next the grit it is filled with quartz pebbles. This was interpreted to be residual clay caused by the decomposition of the shale, through sub-aërial agencies, before it became covered by the grit. The old notions regarding rock-formation required the presence of a body of water in which the sediments might be deposited. Several of the geological subdivisions showed characters which would not have been present had these formations been laid down under water, for this mode of origin results in a sorting of the rock-forming materials, and no sorting is detected in these grits. Flood plain deposits are very irregular, both as to stratification and sorting of materials, and these features are well exhibited in the grits. Other formations that are probably plain-flood deposits are parts of the Potsdam sandstone in eastern New York, the Medina sandstone, the sandstones of the Catskill group, and many of the sandstones of the coal measures of Pennsylvania and the Mississippi valley—in fact the greater part of the 'Barren Measures.'

Dr. Theodore G. White presented notes on 'The Glen Falls, N. Y., section of the Lower Ordovician,' described his detailed study of the faunas of successive strata at Glen Falls, and their relations to similar studies along the Lake Champlain valley to the north, and the Mohawk and the Black River valleys to the west. The section forms a low anticline along the shore of the Hudson. At the base is seen the Calciferous sandrock, containing *Ophileta* and fucoids. Conformable upon this is a layer a few inches thick, of barren black shale, which is very much crushed, and then the same beds of the ostracod, *Leperditia*, and their associated corals and peculiar forms of *Strophomena*, as have been found in the lowest Black River zones on Button Island in Lake Champlain. The zones of *Parastrophia* and *Triplesia*, occurring near this portion of the series in localities to the north and west, were not found here. The succeeding coral beds of *Columnaria* were well developed. Above these are the cross bedded gray beds, which in some recent reports have been considered to represent the Birdseye limestone, which seems to be lacking in this locality, unless met with at this unexpectedly high position. The upper portion of the section, which is of lower Trenton age, shows no unusual forms. The tendency of the lowest and the uppermost portions of the Ordovician sections in the region to wear away and appear wanting, owing to their prevailing softness, was commented on.

Dr. Henry S. Washington read a paper on 'The Rocks of Lake Winnipesaukee, N. H.,' as a preliminary report on work done by Professor Pirsson and himself on Mount Belknap and Red Hill, near Lake Winnepesaukee, N. H. The rocks of Mount Belknap are shown to be prominently a quite uniform alkali syenite, which is cut by many dikes of camptonite and allied rocks, and of bostonites, aplites and syenite-porphyries. These dikes also cut the surrounding porphyritic gneiss. At one place, near the border, is a mass of basic hornblende-gabbro, with large, poikilitic phenocrysts of brown hornblende. A syenite breccia also occurs. At Red Hill similar syenite, formerly described by W. S. Bayley, occurs on the summit, while, toward the periphery, nephaline appears as a constituent, and a true foyaite is developed. The massif is also cut by dikes, both camptonitic and syenitic. The region is to form the subject of a petrographic study by the two geologists in the near future.

Professor Daniel S. Martin described a visit which he paid during the summer to the noted mineral locality at Haddam, Maine. He described the manner in which the choicest specimens occur there, in veins of albitic pegamatite, with tourmaline, muscovite and quartz along the contact with the wall of gneiss. The mica plates along the contact are often two feet in diameter.

Dr. A. A. Julien in his paper 'The Geology of Central Cape Cod' reviewed the opinions of

Mitchell, Davis, Shaler and others on the geology of Cape Ann, with especial reference to the district from Chatham to Yarmouth. In the stratified deposits of sands and gravels which underlie the plains south of the morainal 'back-bone' of the Cape, the more frequent intercallation of clays was pointed out, and the occasional disturbance and flexure. Striated pebbles, although much water-worn, are quite largely interspersed. The discovery of true glacial silt at some depth in one locality indicates that the ice-sheet there rested, instead of floating. The kettle shaped hollows and pond-basins were shown by the speaker to be largely connected with the damming of surface streams, and some observations on the pre-glacial drainage valleys and topography were discussed. The identification of certain transported fragments of quartz-porphyry with outcrops of the same near Marblehead indicate a pre-glacial movement from N.N. W. to S.S. E. To the fifteen changes of level which have been recorded, a final small elevation probably should be added, judging from the low terrace along this part of the coast. Examples of the facited pebbles were exhibited and provoked considerable discussion among those present as to the origin of those pebbles.

Professor Richard E. Dodge recounted his pleasure in visiting the region of the Colorado Canyon, during the past summer, in company with a party, and finding the physiography, as graphically illustrated in the drawings in Powell's reports, to be a most faithful and non-diagrammatic portrayal of the features themselves. He then described the striking examples of gigantic geophysical results seen in the Great Kiabab anticline, the Grand Canyon itself, and the Kiabab plateau and its faults. He also described the appearance of the great basin of 'Lake Bonneville.'

Remarks on foreign localities visited by them during the summer, were made by Professor J. J. Stevenson and Dr. E. O. Hovey.

THEODORE G. WHITE,
Secretary of Section.

SECTION OF ANTHROPOLOGY AND PSYCHOLOGY.

THE regular meeting of the Section was held on November 26. The first paper was a report of the Paris Congress of Psychology by Dr. R. S. Woodworth. This report was more detailed than the published accounts and also suggested certain questions in regard to the enlargement and control of American representation at similar congresses in the future.

The second paper, by Mr. Clark Wissler, on 'Correlation of Anthropometric Tests,' reported some results of a series of mental and physical tests upon students in Columbia University and Barnard College. The young women of Barnard College were found to be superior to Columbia freshmen in the tests for time of perception, naming of colors and resistance to pressure; they were equal to the freshmen in rate of fatigue, perception of weights, sensation areas, perception of size and logical memory; they were inferior in size of head, strength of hand, reaction time, association time and auditory memory. There is some probability that the young women are superior in perception of pitch and inferior in movement time. With the freshmen who repeated the test in their senior year an improvement was found in all except sensation areas and perception of size, though the difference in some cases is slight. It was also found that the seniors showed a decided tendency to hold the same relative rank as when freshmen, thus indicating a general advancement of the group during college life. In correlations it appeared that logical memory and length of head are related characteristics, but length of head also correlates with lung capacity and strength of hand. The work has not gone far enough to say which of these has the most weight. Attempts to correlate reaction time and the other tests of quickness gave no results.

The third paper, presented by Dr. E. L. Thorndike, reported the results of certain experiments on the 'Effects of Special Training on General Ability.' These experiments were performed jointly by Drs. Woodward and Thorndike. The results of a number of experiments show that when any mental function is trained in connection with certain data, the improvement is not of the function in general. If different data are used there will be less or even no improvement shown. The general theory that the mind equals a number of special

abilities, independent to a degree hitherto unsuspected, was supported further by the great variability in our judgments of slightly differing magnitudes.

The fourth paper, by C. H. Judd was on the 'Movements of Writing.' These movements were analyzed by means of tracers attached to the hand, back of the fingers, and to the arm, back of the wrist. The written words give the sum of all the movements of arm, hand and fingers. The hand tracer gives only arm and hand movements, omitting finger movements. The arm tracer shows arm movements only. The general result of this analysis shows that the arm carries the hand forward and participates only to a very small degree in the formation of the letters and words. The gross movements, especially those which are upward and forward, in the formation of the letters, are performed by the hand. All the finer curves and more delicate lines of the letters are formed by the fingers. The muscular coordinations of the different individuals tested, while differing greatly in detail characteristics, all show this general type of movement. No results were presented from subjects who write naturally with a full arm movement.

Charles H. Judd,
Secretary.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

The 524th annual meeting of the Society was held on Saturday night, November 24th, at the Cosmos Club.

Under the title of 'An Attempted Solution of the Social Problem,' Mr. B. Pickmann Mann described the organization and history of the People's Real Estate Tontine, a philanthropic institution incorporated under the laws of New York State as a building and loan association, with the purpose of providing an annual income of increasing value with increase of age, especially for the relief of superannuated persons from poverty. The officers and trustees of this Association serve gratuitously and it has been endowed by gifts from many persons. This account of the last eight years' growth of the Association supplemented an account of the first eight years' growth, given before the Society by Mr. Mann under the same title in 1892.

The second paper was by Mr. F. O. Radelfinger, whose topic was 'Divergent Series.' After some preliminary remarks on the origin of divergent series, in which he pointed out a distinction between those which rise naturally from investigation in mathematics and those which are simply hypothecated, he passed to the consideration of some recent investigations by Borel.*

A first power series, assumed to be either divergent or convergent was written down, and a second more convergent series obtained from this by multiplying each term by a uniformly decreasing factor $a^n/n!$ A relation between these two series was to be deduced, which relation was expressed as a definite integral of a function of the second or derived series and certain simple transcendentals. Some applications of this relation were then given and its use in rendering the first series convergent in extending its original domain of convergence was pointed out. The relations discovered by Steitjie between certain divergent series and continued fractions were stated and their extension by Borel mentioned.

E. D. Preston,
Secretary.

GEOLOGICAL SOCIETY OF WASHINGTON.

The 105th regular meeting was held November 28, 1900. The following papers were presented:

Mr. Arnold Hague, 'Account of the International Geological Congress at Paris, 1900.'

Mr. F. L. Ransome, 'The Fissure Systems of the Silverton Quadrangle, Colorado.'

The remarkably numerous and persistent fissures, in which occur most of the ore bodies of this portion of the San Juan Mountains, were described and classified. It was concluded that the forces which produced the fissuring were local in character and practically confined to the fissured area. They were probably genetically connected with the eruption and local accumulation of great thicknesses of volcanic rocks upon an ancient eroded basement.

F. L. Ransome,
David White,
Secretaries.

* *Annales de l'Ecole Normale*, 1899.

BIOLOGICAL SOCIETY OF WASHINGTON.

THE 328th meeting was held on Saturday evening, November 17th, and was devoted to a popular symposium on the subject of 'Malaria from a Biological Standpoint.'

C. W. Stiles described 'The Structure and Life History of the Parasites of Malaria,' illustrating his remarks with numerous diagrams. He noted the various theories regarding malaria and pointed out the steps by which our present knowledge of its cause had been reached, stating that Dr. A. F. A. King was the first to suggest that the mosquito was the direct agent in transmitting the disease. The manner in which the parasite passed from the water to the mosquito and thence to man was described in some detail, and the fact brought forward that various animals are subject to malaria produced by different parasites than those which cause the malaria of man.

L. O. Howard discussed 'The Malarial Mosquitoes, their Biology, what has been done and what may be done to Exterminate Them,' giving a full description of the biology of *Anopheles*, contrasting it with the life history of *Culex* and with the recently discovered and as yet unpublished life history of *Psorophora*, illustrating his remarks with lantern slides. He dwelt at some length on the subject of mosquito control, describing the different remedies and mentioning some cases in which, during the past summer, not only had the mosquito supply been greatly diminished, but in one malarial village malaria had practically been eradicated. He also described at some length the results of a very interesting experiment in community work at Winchester, Va., where the treatment of mosquito breeding-places was made, during the past summer, a police measure.

F. A. LUCAS,
Secretary.

ZOOLOGICAL JOURNAL CLUB OF THE UNIVERSITY OF MICHIGAN.

AT the meeting of November 15th, Mr. Raymond Pearl gave an account of work carried on at Woods Holl on the reactions of the embryos and larvæ of *Limulus*. The normal movements and reactions of the adult had been studied, and a brief prefatory account of these was given. With this as a basis, the question was investigated whether there occurs a *development of reactions* comparable with the structural development. The results showed a distinct parallelism in many respects between the morphological development on the one hand and the psycho-physiological development on the other.

The Walking Movements.—Some time before the animal leaves the egg shell (or more properly, the 'vicarious chorion') purposeless kicking movements of the legs appear. After hatching, these movements continue, but gradually become coordinated by practice, until the perfected walking movement is produced from them.

The Swimming Reflex. — The swimming movements of the larva in the tribolite stage and for a week following the moult which terminates that stage are different from those of the adult. The adult swims by a combined, coordinated movement of the thoracic and abdominal appendages. In the young larvæ swimming takes place by the action of the gills, the legs being held perfectly quiet, strongly extended over the anterior edge of the thorax. The gills of the larva beat rhythmically from the first in a perfectly coordinated way. This movement begins within an hour after the animal leaves the 'vicarious chorion'; it is clearly a reaction due to the stimulation produced by direct contact of sea water with the gills.

Normal respiratory movements begin some time before hatching. The complicated chewing reflex of the adult is absent in young larvæ. The burrowing habit arises as a modification of the thigmotactic response of the larva.

To mechanical stimulation there is but one response, and this is the same, whatever part of the body is stimulated.

The phototactic, geotactic, hydrotactic and general thigmotactic reactions were discussed.

All the reactions were found to be of a peculiarly definite machine-like character, as if each were the result of the starting into activity of a distinct mechanism by a stimulus. The reactions appear as soon as their mechanisms are developed. So long as the mechanism is intact the response always takes place in the same way. The reactions can be analyzed into

more or less simple, but distinct and specific, reflexes.

The fourth meeting was held November 22d. Dr. S. J. Holmes gave an account of some experiments on the development of fragments of the egg of *Pennaria*.

Mr. Raymond Pearl presented the results of a study of the motor reactions of the ctenophore *Mnemiopsis leidyi*.

Attention was directed especially to the question of how the organism moves with reference to the position of external objects acting as stimuli. To localized mechanical stimuli two distinct motor reactions were found to occur, depending on what part of the body was stimulated. (1) Stimulation in the region about the aboral pole caused an increase in the strength of the beat of the comb-rows, resulting in a movement of the animal straight ahead (toward the oral end): therefore *away* from the source of stimulation. (2) Stimulation of any other region of the body causes the following reaction: (*a*) the lobes close strongly, thus expelling the water rapidly and causing the animal to move backward (toward the aboral end). At the same time the comb-rows cease to beat. (*b*) The comb-rows on the side stimulated remaining partly or entirely quiet, the other comb-rows begin to beat strongly, carrying the animal forward and at the same time of course usually turning it *toward* the source of stimulus (never toward the opposite side). As the animal thus moves toward the source of stimulus the lobes are opened widely and the tentacles thrown back. This movement frequently brings the mouth of the animal against the stimulating agent, if the latter remains in place. This response is perhaps a *food reaction*. (This account is of a perfectly typical case, from which there are individual variations.)

Experiments were made on the relation of the central nervous system to the coordination exhibited in the contraction of the lobes. It was found that in animals from which the whole aboral end had been removed, including the whole of the central nervous system, there was still perfect coordination in the contraction of the lobes of the two sides. When a single lobe was removed from the body and split lengthwise so that the two parts remained connected only by a small bridge of tissue, the contraction of the two longitudinal halves was still found to be well coordinated.

H. S. Jennings,
Secretary.

Science Club of the University of Wisconsin.

The Science Club of the University of Wisconsin held its first meeting of the academic year on the evening of November 27th. Dr. E. A. Birge, the new president of the Club and the acting president of the University, delivered an address upon 'Huxley.' Because of the very general interest of this address, the meeting was an open one and the large lecture hall of the University was crowded. Dr. Birge analyzed the qualities of mind and heart which characterized the great expositor of the doctrine of evolution. An interesting contrast was instituted between Huxley upon the one hand and first Matthew Arnold and then Gladstone upon the other.

While warmly sympathetic and eulogistic to a high degree, Dr. Birge's estimate of Huxley was in essential agreement with that of Gladstone, whose judgment was that however great Huxley's talents, he was not a genius.

Wm. H. Hobbs.

The Academy of Science of St. Louis.

At the meeting of the Academy of Science of St. Louis on the evening of November 19th, Mr. C. F. Baker exhibited a large amount of living and preserved material, including microscopic preparations, illustrative of American Isopods and Amphipods, accompanying the demonstration by a short *résumé* of the work thus far done on Crustaceæ, particularly on these two groups, and making some interestingly suggestive remarks on the peculiar affinities of a number of the species found in deep wells or hot springs.

Dr. Amand Ravold presented an abstract of the results reached in some recent bacteriological examinations of water from the Illinois, Mississippi and Missouri rivers, particularly concerning certain features of the occurrence and abundance of *Bacillus coli-communis*.

One person was elected to active membership.

WILLIAM TRELEASE,
Recording Secretary.

DISCUSSION AND CORRESPONDENCE.

VON IHERING'S ARCHIPLATA–ARCHELEMIS THEORY.

IN SCIENCE for December 7th, Dr. H. von Ihering gives a condensed statement of his views on the origin of the South American fauna. This is the more welcome, since the original publications of v. Ihering, although dating back to 1890, are not very well known, chiefly because these articles (of which v. Ihering gives a list) have been published in periodicals, in which hardly anybody would look for them. Part of them are of a mere popular character, while another part are too much out of the way, and they do not, by their titles, give any indication that we might look in them for a discussion of zoogeographical topics of general interest.

As regards the chief idea of v. Ihering, that South America consists, genetically, of two different parts, *Archiplata* and *Archamazonas*, which have become united subsequently, I am of the opinion that this theory is well worth discussion. Indeed, I have accepted this theory in my studies of the distribution of the fresh-water Decapods, and have been able to collect further material in support of it. And further, in the report on the Tertiary Invertebrates of Patagonia, collected by the Princeton Expedition, which is in course of preparation, I shall again refer to this theory as a very acceptable one for the explanation of certain features in the distribution of marine animals. Therefore, I was much surprised to see that v. Ihering refers to my studies on the freshwater crabs and crayfishes as at variance with his theory, for only in this sense I can interpret his reference to my 'biologic' barrier.

My theory of a 'biocœnotic barrier' formed by the *Potamonidæ* (tropical fresh-water crabs) for the *Potamobiidæ* and *Parastacidae* (crayfishes, restricted to the extratropical parts of either hemisphere) was formulated to explain only the *Bipolarity* of the latter groups, without any reference to the special conditions in South America, but chiefly in respect to those prevailing in the old world.* I shall discuss this question again,† and shall pay particular attention to the South American conditions with reference to v. Ihering's theory: I think that the South American *Parastacidæ* are members of the old Archiplatan fauna, and are connected genetically with the New Zealandian and Australian *Parastacidæ*, and have reached these parts apparently by way of a land connection across the Antarctic regions, while the South American *Potamocarcininæ* (subfamily of *Potamonidæ*) are characteristic of the old Archamazonian fauna, and point possibly to a former connection of the latter with Africa (v. Ihering's *Archhelenis*). In this connection I must add that v. Ihering's argument, given in the article referred to, as to the coexistence of *Potamocarcininæ* and *Parastacidæ* in southern Brazil is probably a mistake: there are to my knowledge no *Potamocarcininæ* in southern Brazil, but the fresh-water crabs of small size, to which he probably alludes, are *Trichodactylinæ*, the genetic relations of which are doubtful. They have nothing at all to do with my 'biocœnotic barrier,' and certainly do not 'annul' it.

In favor of the theory of a former disconnection of the northern and southern parts of South America I may call attention to other considerations. A communication of the Atlantic and Pacific Oceans in Tertiary times is generally accepted, and this connection is chiefly placed at Panama. Now (according to Hill), ‡ the Isthmus of Panama was land since Mesozoic times (with only an unimportant interruption at the end of the Eocene); but Hill himself admits that there must have been a connection of oceans somewhere in the Tertiary. The theory of v. Ihering gives us a clue to this. If we move the interoceanic connection from Panama southward, and construct it where there must have been the sea separating Archamazonas and Archiplata, that is to say, across

* See 'Bipolaritaet' in: Zool. Jahrb. Abt. f. Syst. v. 9. 1896, p. 593.

†'Decapoden' in Bronn's 'Klassen und Ordnungen,' vol. 5 Abteil. 2, p. 1289. This part has not yet been issued, and I am quoting from proof sheets.

‡ *Bull. Mus. Comp. Zool.*, v. 28, No. 5, 1898.

the South American continent about where there is now the Amazonas valley, we should still have a communication between both oceans within the tropics. Just this kind of connection is demanded by the facts that have led to the assumption of an interruption of the isthmus of Panama.

The former connection of v. Ihering's Archiplata with a supposed Antarctic continent is no new theory, but goes back, in this form, as far as Rütimeyer (1867), and I have no doubt that we should accept it.* But we hardly can accept it in the shape of Forbes' 'Antarctica' (1893). This huge continental mass is simply impossible, and Professor Osborn (SCIENCE, April 13, 1900) has very properly tried to restrict it to a reasonable size; but I think we should still more contract its boundaries. In this respect I should follow Hedley's† views, who practically, but without giving a map, accepts the limits of the present Antarctic continent (as defined by Enderby, Wilke's, Victoria and Graham Land), with only such extensions as are absolutely necessary to connect it with the present southern continents.

A. E. ORTMANN.

PRINCETON UNIVERSITY,
Dec. 7, 1900.

* An historical account of the different theories advanced for the explanation of the relations of the southern faunas, and a classification of them, will shortly be published in the *American Naturalist*.

† Proc. Roy. Soc. N. S. Wales, 1895, August 7th.

THE LONGEST AERIAL VOYAGE.

TO THE EDITOR OF SCIENCE: The official report just received of the long-distance balloon race from Paris on October 9th, changes somewhat the figures on page 799 of SCIENCE, which were those furnished to the press. It appears now that Count de La Vaulx and a companion traveled 1,200 miles in 35 hours and 45 minutes in the basket of a balloon containing only 57,000 cubic feet of illuminating gas. They reached a maximum height of three and a half miles, crossed Germany and landed in Russia, as did another of the contestants. This is probably the longest continuous voyage in the air ever made, although it was nearly equaled forty years ago by our countryman, John Wise, who, with two companions, went by balloon in 19 hours from St. Louis to Jefferson County, New York, a distance of 1,150 miles.

It is evident that, under the management of an aëronaut, a balloon can be kept longer in the air than an unmanned balloon, but, nevertheless, a balloon of 8,700 cubic feet capacity, carrying only self-recording instruments, which was liberated from Berlin in 1894, after attaining a height of ten miles was carried 700 miles to the borders of Bosnia, at a speed of 62 miles an hour. Still more remarkable, in its way, was the flight of a pair of kites last summer from the Royal Aëronautical Observatory near Berlin. Five kites, which had lifted self-recording meteorological instruments to a height of two and a half miles, broke the wire that confined them to the ground and the two upper kites dragged it across the country for nearly a hundred miles before they were finally checked, the trailing wire, two miles in length, furnishing sufficient resistance to keep the kites flying throughout the night.

A. LAWRENCE ROTCH.

BLUE HILL METEOROLOGICAL OBSERVATORY,
November 30, 1900.

'THE CRIMINAL, HIS PERSONNEL AND ENVIRONMENT.'

TO THE EDITOR OF SCIENCE: Disclaiming in any sense to answer the attack upon my recently published book, 'The Criminal, his Personnel and Environment,' emanating from the pen of Mr. Havelock Ellis and published in your valued journal of the 19th inst., I nevertheless deem it but justice to myself to ask of my critic a verification of the assertion therein made, that: "When he (the author) mentions authorities he is unable in *a large proportion of cases* even to *spell their names*" (the italics and parentheses are my own). Now, as I happen to cite a very large number of names, and while fully conscious of my liability to err, the charge is an exceedingly broad, if not hazardous one, which, if failing to substantiate, will lay my critic open to a grave counter-charge. I respectfully challenge Mr. Ellis to make good his proofs, which, if true, may readily be done. In the event of his ina-

bility so to do, I then ask for a *modicum* of such proofs, and failing in this, and, in view of the fact that I am just completing the proof sheets for the second edition (since March) of my book, I should deem it in the light of a personal kindness as well if he would favor me with the evidence of one or more such errors, naming paragraph and page.

As to any further animadversion upon my work, I am willing to leave its merits to the just judgment of the reading public and my colaborers in the field of practical penology rather than to the dictum of the study and the essay of theorists at long range.

AUGUST DRÄHMS.

SAN QUENTIN, CAL.

At Mr. Drähms's request I have rapidly turned over the pages of his book and noted down a few of the liberties taken with the names of authors quoted or referred to:—Taylor (for Tylor), *passim;* Galt (for Gall) p. 22; Von Homel (for Van Hamel) p. 23; Ferrer, (for Ferrero) *passim;* Tamborini (for Tamburini) p. 46, Tyndale (for Tyndall) p. 51; Masso (for Mosso) p. 69; Gradinger (for Gradenigo) p. 78; Berdier (for Bordier) p. 87; Herman Schaafhausen (for Hermann Schaaffhausen) p. 95; Lelart (for Lélert) p. 105; Weissmann (for Weismann) *passim;* Thompson (for Thomson) p. 138; Delboef (for Delbœuf) p. 319; Frey (for Fry) p. 334. It would be easy, but is probably unnecessary, to enlarge this list very considerably. Some of the names are so changed that it is hazardous to identify them, more especially since Mr. Drähms seldom supplies definite references. When he does they are sometimes remarkable. Thus I find (p. 95) a reference to Ecker given as 'Crania Germanice,' *Merid. Occid.*, Freib. i. p.'; it may interest Mr. Drähms to know that this being interpreted, means '*Crania Germaniæ meridionalis occidentalis*, Freiburg, i/Br.'

Mr. Drähms will, I hope, believe me when I say that the other statements in my review may be as fully proved as that to which he takes special exception. He is mistaken in thinking that I wish to 'attack' his book; I have no desire whatever to judge him hastily. But he has chosen to challenge examination of his book as a 'scientific study,' and he must not feel aggrieved when it is submitted to very elementary tests of scientific precision.

HAVELOCK ELLIS.

LELANT, CORNWALL.

NOTES ON INORGANIC CHEMISTRY.

THE use of acetylene in the blast lamp has been tested by many experimenters, and it has been found possible to obtain easily a heat at which gold can be readily fused. In the October *Moniteur Scientifique*, G. L. Bourgerel has described experiments in replacing air in the acetylene blast lamp with oxygen. When pure oxygen is used the flame becomes highly luminous and deposits carbon in very compact form, much resembling gas carbon. When, however, a mixture of air and oxygen is used with acetylene, the gas is completely burned, and it was found possible to obtain a temperature high enough to fuse platinum. There would seem to be no particular practical advantage in the use of this flame over the commonly used oxygen-coal-gas blast lamp.

HYDROGEN tellurid was discovered by Davy, in 1810, by the action of hydrochloric acid on sodium tellurid, but the gas has never been obtained pure, and beyond its odor and its instability comparatively little has been known of its properties. The problem has been taken up by Dr. Edmund Ernyei, of Budapest, and his results are described in the last number of the *Zeitschrift für anorganische Chemie.* After testing several methods, the best was found to be the electrolysis of 50 per cent. sulfuric acid by a 220 volt current with a tellurium kathode. The apparatus was kept at a temperature of —15° to —20° and the evolved gas dried immediately over calcium chlorid and phosphorus pentoxid. It was then condensed by the use of liquid carbon dioxid, and formed orange-yellow crystals which melt at —54° to a greenish yellow liquid. This hydrogen tellurid proved to be practically pure. Its boiling point is slightly above 0°, but it decomposes quite rapidly below this temperature into tellurium and hydrogen. It is quite soluble in water, but its solution decomposes on contact with the air. In caustic alkalies it dissolves, forming alkaline tellurids, which decompose readily, and on standing these become dark

red from the formation of polytellurids. Its density was obtained by the Dumas method, and by rapid working the decomposition was so slight as to have no appreciable effect upon the result. The value found was 65.1 which corresponds to the formula H_2Te. From this the molecular weight would be 130.2. These properties of hydrogen tellurid correspond to the position of tellurium in the sulfur-selenium group, while the high molecular weight agrees well in confirming the best atomic weight determination of tellurium, which places it above and not below that of iodin.

In connection with the proposed formation of a new 'Society of Chemical Industry of Victoria,' a correspondent of the *Chemical News* takes exception to the term 'English Society' by the Honorable Secretary of the Victoria Society as applied to the Society of Chemical Industry, in the following language: "Our Society is not, I think, an 'English' Society merely; it is not merely a British Society; it is an Anglo-American Society. Its President of last session was an American, and I believe we are proud of both these facts. * * * It seems strange that Mr. Gepps in his circular should omit our most prosperous and rising section, next to that of London, viz., the New York Section of the Society of Chemical Industry. He probably would not have made the omission, however, had he been present at our annual general meeting this summer, and witnessed the enthusiastic reception accorded to our American President, and have heard his address, and especially his speech at the annual dinner of the Society. If there is one thing we of the Society of Chemical Industry are more proud of than another, it is of the fact that in the Society and its journal the hands of British and American technical chemists are united—spite of the broad Atlantic—in a brotherly grip." To all of which we say Amen.

J. L. H.

JESSE WILLIAM LAZEAR.

At a meeting of the Johns Hopkins Hospital Medical Society on October 16th, Dr. W. S. Thayer, referring to the recent death from yellow fever of Dr. Jesse William Lazear, addressed the Society as follows: Before we proceed with the program this evening, I should like to say a few words about our dear friend Lazear, whose sad death at Quemados, Cuba, on September 25th, is so fresh in our minds. Lazear was born just outside of Baltimore thirty-four years ago. He graduated at the Academic Department of the Johns Hopkins University in 1889, and three years later obtained the degree of M.D. from Columbia University, New York. After this he was an interne in the Bellevue Hospital for two years. After spending the greater part of the year in studying abroad, particularly in Paris, he returned in 1895 and became one of the medical staff of the Johns Hopkins Hospital. In the summer of 1896, Dr. Lazear was married and began the practice of medicine in Baltimore. At the same time, however, he was an assistant in clinical microscopy in the University, and in the laryngological department in the Hospital dispensary. Last winter he obtained an appointment as assistant surgeon in the army with special laboratory duties, and was stationed in Havana. There he soon became interested in the study of yellow fever, and for several months he had been one of the commission appointed by the Surgeon General, for the study of this disease. He had been constantly exposed to infection, and finally, in the course of his duty, contracted his fatal illness.

Dr. Lazear was a man of few words but keen perception. He was an extremely careful and thorough worker. He kept his own counsel, asked few questions and little help of his associates, but he was a man who, when he started an undertaking, had the ability and enthusiasm to keep quietly at work until he accomplished his end. It was through his excellent work that we were able several years ago to make our first positive *intra vitam* diagnosis of septicæmia due to the diplococcus of Neisser. His valuable studies upon the internal structure of the malarial parasite, which I had the pleasure of bringing before this Society last winter, are remembered by all.

Personally, he was an exceptionally simple, high-minded and lovable man. He could not have failed to find in a short time a public position in which his unusual merits would have become more generally known.

I should like to suggest to the Society the adoption of the following resolutions :

"*Whereas*, On the 26th day of September, our beloved colleague and friend, Jesse William Lazear, lost his life in the discharge of his duty as a member of the United States Yellow Fever Commission ;

"*And whereas*, His exceptional ability in his profession, his simplicity and modesty as a man, had greatly endeared him to all whose good fortune it was to know him ;

"*Be it resolved*, That we, his former colleagues and associates, do hereby express our profound sorrow at the loss to the community of one whose future was unusually rich in promise, to ourselves, of a dear friend and fellow student ;

"*And be it further resolved*, That we express to his wife and family our warmest and most heartfelt sympathy.

The resolutions were unanimously adopted.

SCIENTIFIC NOTES AND NEWS.

THE mid-winter meeting of the Council of the American Association for the Advancement of Science will be held at 1 o'clock, P. M., Friday, December 28th, in Room 12, McCoy Hall, Johns Hopkins University, Baltimore.

AT the anniversary meeting of the Munich Academy of Sciences on November 14th, Professor W. C. Röntgen was elected an ordinary member; Professor S. Günther, of Munich, was elected an associate member ; Professors W. Wundt, Leipzig, O. Bütschli, Heidelberg, W. His, Leipzig, and H. de Vries, Amsterdam, were elected corresponding members, and Professor Poincaré, Paris, a foreign member.

DR. KARL KLEIN, professor of mineralogy at Berlin, has been elected a corresponding member of the Paris Academy of Sciences.

THE Cross of Commander of the Legion of Honor has been conferred by the president of the French Republic on Sir William McCormac, president of the Royal College of Surgeons of England.

OXFORD University will confer the degree of D.Sc., *honoris causa*, upon Dr. Oliver J. Lodge, principal of the University of Birmingham.

THE Berlin Academy of Sciences has made the following appropriations: To Herr Engler, toward the publication of 'Das Pflanzenreich,' 2,000 Marks; to Professor Otto Lehmann, of Karlsruhe, for the continuation of his investigations on fluid crystals, 1,200 Marks; to Professors Friedrich Paschen and Karl Runge, Hanover, for an electro magnet, 1,400 Marks, and to Dr. Karl Peter, of Breslau, for studies on the development of lizards, 500 Marks.

DR. H. M. SMITH, of the U. S. Commission of Fish and Fisheries, has recently returned from a three month's trip to Europe, during which he visited a number of biological stations, including those at Plymouth and Naples. At the International Congress of Fisheries and Agriculture, held at Paris in September, Dr. Smith was the official delegate of this government.

A BUST of Charles H. Haswell, the first engineer-in-chief of the U. S. Navy, is in process of completion, by Dunbar, for the Union Club of New York. Mr. Haswell is now in his ninety-second year and is still active, going to business every day and looking no older, his friends say, than he did thirty years ago. He was the first officer in the navy to introduce scientific methods in engineering and constructed the engineer corps of that service. After he had organized the corps, he designed much of the then novel machinery of steam propulsion. A few of his steam war vessels still survive, in retirement. He published the first table-book for engineers, and that famous pioneer work is still published by the Harpers, and has passed through about fifty editions in something over a half century. His semi-biographical 'History of New York' is probably better known to the majority of his fellow townsmen.

CAMBRIDGE University will confer its M.A., *honoris causa*, on Mr. G. H. F. Nuttall, M.D., (California), Ph.D. (Göttingen), university lecturer in bacteriology and preventive medicine, and on Mr. T. Strangeways Pigg, university demonstrator of pathology.

DR. H. R. MILL has resigned the librarianship of the Royal Geographical Society, and will be succeeded by Mr. E. Heawood.

WE learn from *Nature* that at the annual meeting of the Royal Geological Society of Cornwall, Dr. Le Neve Foster was presented with the William Bolitho gold medal in recog-

nition of the distinction which he has attained as a mineralogist, and also of the great services rendered by him to the Society as curator during the period when he held the appointment of inspector of mines for Cornwall and Devon.

THE committee on a memorial of the late Dr. Joseph Coats, who was the first occupant of the chair of pathology in the University of Glas gow, has established a scholarship to be known as the 'Joseph Coats Memorial Scholarship in Pathology,' for the encouragement of original research. The value of the scholarship, which will be awarded once in two years, is the income of the endowment of £1,200. A brass memorial tablet will be placed in the Pathological Institute at the Western Infirmary, Glasgow.

PROFESSOR JOHN GARDINER, LL.D., who occupied the chair of biology in the University of Colorado, at Boulder, Colorado, from 1889 to 1898, died as a victim of consumption on November 26. Professor Gardiner, who was thirty-eight years of age, was a graduate of the University of London, B.Sc., 1884, and was awarded the table of the British Association at the Naples Biological Station in 1887. He was an enthusiastic student of biology, a man of rare culture in other lines and a stimulating teacher and lecturer.

WE regret to record the death of Dr. Adolph Pichler, at Innsbrück, at the age of 81 years. Dr. Pichler was for many years professor of geology at Innsbrück and was at the same time one of the more eminent German poets and men of letters. He was the author of tragedies, epics and lyric poems which are much esteemed by the critics. Even if there were only the names of Pichler and Camisso, the eminent German poet and botanist, it would be proved that a man of science is far more likely to be a poet than is the average man.

THE death is announced of Professor M. F. Kovalskij, professor of pure mathematics at Charkow; of Emanuel Formánek, professor of pharmacology at the Bohemian University of Prague, and of M. A. Pellerin, director of the botanical garden at Nantes.

PROFESSOR GEORGE E. HALE, director of the Yerkes Observatory, asks us to announce that appointments will be made to two new positions on the staff of the Observatory, before July 1, 1901. The holders of these positions will be expected to devote the principal part of their time, a specified number of hours per day, to the measurement and reduction of photographs of spectra or to other work of computing. Opportunity will also be given to become familiar with the investigations in progress at the Observatory, and perhaps to take part in them during hours not devoted to measures and reductions. The applicant should be familiar with the practical use of the method of least squares, and must possess good eyesight. Preference will be given to men trained in the measurement and reduction of photographs. It is probable that one of the positions will be given to a man experienced in astronomical methods, the other to one whose work has been mainly in a physical laboratory. In neither case can assurance be offered that the appointment will be for more than one year, as funds are not now available for a longer period. The salary will be $800. As it is desired to fill one of the positions about January 1, 1901, applications may be sent at once to the director of the Yerkes Observatory, Williams Bay, Wisconsin.

THE Postmaster-General issued, December 5th, the following order, No. 1,851: "Ordered: That Theodore C. Search, President of the National Association of Manufacturers, Philadelphia, Pa.; R. H. Thurston, director of Sibley College, Ithaca, N. Y.; Wm. F. King, president Merchants' Association, New York; Alfred Brooks Fry, chief engineer and superintendent of repairs, U. S. Public Buildings, New York, N. Y.; Wm. T. Manning, consulting engineer, Baltimore, Md.; and Frederick A. Halsey, mechanical engineer and editor *American Machinist*, New York, N. Y., be and they hereby are appointed a committee of experts to give consideration to all matters pertaining to the use of pneumatic tubes for the transmission of mail and to advise the Postmaster-General thereon pursuant to the Act of Congress approved June 2, 1900." The committee met December 10th and will report within ten days, advising the Postmaster-General regarding the lease or the purchase, the extension, the restriction, or the disuse, of that system of trans-

mission of mail matter. It is now in use in New York, Philadelphia and Boston, and is asked for in other large cities.

A DESPATCH from Berkeley states that Mr. D. O. Mills, of New York, has promised the University of California about $24,000, to defray the expenses of a two years' astronomical expedition from the Lick Observatory to South America or Australia, the object of which is to study the movement of stars in the line of sight.

MR. GEORGE WHARTON JAMES will lecture before the Philadelphia Academy of Natural Sciences on the 14th instant on 'The Wallapais: the Bedouins of the Painted Desert of Arizona.' The illustrations will be from photographs taken last summer. Dr. John W. Harshberger will make a communication at the regular meeting of the 18th inst. on the 'Ecology of the New Jersey Strand Flora.'

DR. A. DONALDSON SMITH, the African explorer, is to lecture before the Philadelphia Geographical Society on January 2d.

WE regret to hear that the fine collection of Mr. Jas. L. Bowes, of Liverpool, the basis of Audsley and Bowes' 'Ceramic Arts of Japan' is likely to be sold and dispersed.

A COLLECTION of 1,200 Indian baskets has been presented to the Ferry Museum of Tacoma, Washington, by Captain Tozies.

THE geological survey of Louisiana will be continued this winter as usual under the immediate direction of Professor Harris, of Cornell University. He leaves for New Orleans, December 20th, taking with him Mr. J. Pacheco, a student in the University from Brazil, as assistant in place of Mr. A. Veatch, who has resigned to continue his work at the University.

A TELEGRAM has been received at the Harvard College Observatory, through Mr. Percival Lowell, stating that Mr. A. E. Douglass, while observing the planet Mars on December 7th, saw a projection on the north edge of Icarium Mare, which lasted seventy minutes.

THE Paris correspondent of the London *Times* reports that M. Emile Berr has just announced a scheme, at the head of which are M. Baudin, Minister of Public Works; M. Millerand, Minister of Commerce; M. Leygues, Minister of Education; and M. Alfred Picard, the General Commissioner. The scheme consists in the preservation in that portion of the banks of the Seine on the Quai d'Orsay of 12 out of the 16 Palaces of the Nations in the recent exhibition. The palaces to be taken down would be those of Italy, Turkey and Servia at either end, and the palace of Spain in the middle, the space left vacant to be filled up by the pretty pavilion of Finland, now in the second row. Each palace thus preserved would become a special museum, the fine characteristic country house of England being converted into a museum of hygiene and bacteriology—a museum of honor to the memory of Pasteur and Lord Lister. These 12 museums, which will last ten years at least, would be kept up by the organizers, and the project honors both those who have invented the idea and the nations which designed these palaces. The cost of the undertaking would be about 1,000,000 f.

The Philippine Commission is about to establish an experimental farm about 200 miles from Manila which will be under the direction of Mr. Phelps Whitmarsh.

IN his annual report to the President, the Secretary of the Interior says, concerning the value of Forest preservation by the government: "The forest policy, as inaugurated by my immediate predecessor in office, has been continued during the year, and the results obtained in the conservation of the national forests and the protection of timber on reserved as well as unreserved lands have demonstrated the wisdom of its adoption, and the necessity, in the interest of the public, for its continuance and increased appropriations by Congress for the carrying on of the work. I concur in the commissioner's recommendation that not less than the appropriation of $300,000 for the forest service, in connection with the creation and administration of forest reserves, be continued for next year, with a possible increase in case additional lands are set aside as forest reservations."

THE Association for Promoting Scientific Research by Women offers a prize of one thousand dollars for the best thesis presented by a woman on a scientific subject, embodying the results of her independent laboratory research in the bio-

logical, chemical or physical sciences. The theses must be submitted before the end of the year 1902. Further information may be obtained from the secretary *pro tem.*, Miss Florence M. Cushing, 8 Walnut St., Boston, Mass.

THE Röntgen Society of the United States meets at the Grand Central Palace, N. Y., on December 13th and 14th. A full program is announced, but it does not contain the names that should be represented in a society of this character.

AN International Engineering Congress will be held at Glasgow in connection with the International Exhibition of 1901. The arrangements are being made by the Council of the Scottish Institution of Engineers and Shipbuilders, and Lord Kelvin will preside.

THE New York State paleontologist Dr. John M. Clarke spent several weeks of the last season in Nova Scotia, New Brunswick and Quebec making collections from rocks which have for the most part been regarded by the Canadian geologists as of the same geologic age as the Helderbergian of New York. Careful studies and extensive collections were made at Arisaig, N. S., Dalhousie, N. B., and on the Gaspe peninsula, thus putting the museum in possession of a series of fossils of much importance for correlation and study which are not duplicated in this country outside of the National Museum at Washington. The accessions to the paleontologic collections during the past season, including all that has been acquired in the work above specified, have been not less than 10,000 specimens. The museum has also recently come into possession by purchase of the important collection of Cambrian fossils made by the late Silas W. Ford, of Troy, a very keen observer and careful student of the Cambrian rocks. This collection, though small, contains all the types of species described and illustrated by Mr. Ford, and much of the material is derived from localities at which it seems now impracticable to obtain others.

THE following are the arrangements for the lectures at the Royal College of Physicians of London for 1901: 'The Milroy Lectures on Public Health' will be given by Dr. J. F. Sykes, Medical Officer of Health for St. Pancras, on February 28th, March 5th and 7th; the 'Goulstonian Lectures,' by Dr. Henry Head, F.R.S., on March 12th, 14th, and 19th; the 'Lumleian Lectures' by Dr. Frank Payne, on March 21st, 26th, and 28th, and the 'Croonian Lectures' by Professor Halliburton, F.R.S., in June.

IN the Registrar-General's quarterly report the population of the United Kingdom is estimated at nearly 41,000,000. The births for the last quarter exceed the deaths by 123,952. 105,402 persons were during the same time officially recorded as having emigrated.

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BY the will of the late Rudolph S. Walton, of Philadelphia, the bulk of his estate of $240,000 will go to Bethany College upon the death of his wife.

WE learn from the *British Medical Journal* that the Faculty of Medicine of Paris has decided that provision should be made for the teaching of tropical medicine. A chair of parasitology and another of bacteriology will be established. An appeal is to be made to the public for funds to carry the scheme into effect.

AT a recent meeting of the Board of Trustees of Clark University, Worcester, Mass., the following promotions were made: Dr. Edmund C. Sanford, to be professor of experimental and comparative psychology; Dr. Arthur G. Webster, to be professor of physics; Dr. William H. Burnham, to be assistant professor of pedagogy; Dr. Alexander F. Chamberlain, to be acting assistant professor of anthropology. The Trustees also voted, at the same meeting, to open all the privileges of the University to men and women upon equal terms.

DR. GUSTAV BAUER, professor of mathematics in the University at Munich, has retired at the age of eighty years.

DR. C. E. GUYE has been appointed professor of physics in the University of Geneva. Professor Weiss has been made full professor of mathematics and analytical mechanics at the German Polytechnic Institute at Prague.

DR. BRILLOUIN has been nominated to succeed the late Professor Bertrand as professor of general and mathematical physics at the Collège de France.